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NORTH SHORE RAILWAY.

REPORT

OF THE

CHIEF ENGINEER

UPON THE SITUATION.

WITH SEVEN APPENDICES.

DATED MARCH 4, 1875.



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QUEBEC :
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NORTH SHORE RAILWAY.

REPORT OF THE CHIEF ENGINEER UPON THE SITUATION.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, March, 4th 1875.

MR. PRESIDENT :

I have the honor to submit the following report upon the present situation of the Company's affairs, for the consideration of the Board of Directors, and such other parties as may feel an interest in the speedy completion of the North Shore Railway.

In discussing a matter of this importance, I deem it quite proper, even at the risk of proving tedious, to refer to such facts and circumstances connected with the past history and present condition of the road, as may be calculated to throw light upon the subject; and at the same time, to place the different parties in interest, in a position where they will each see, and feel inclined to bear their due proportion of responsibility.

I. ORGANIZATION OF THE BOARD OF DIRECTORS.

The Board of Directors of this Company is constituted in a somewhat peculiar manner, the idea of the organization evidently being to afford a representation to the different parties in interest, upon the most equitable and practicable basis.

It may be profitable, and I trust not entirely uninteresting to the present members of the Board, to take a rapid glance at the different stages of progress towards the point at which the Board has now arrived, in its system, or basis of organization.

The original charter of the Company, passed April 22nd 1853, provided for the election of nine Directors by the original stockholders.

The original charter of the "St. Maurice Railway and Naviga-

tion Company," (now the "Piles Branch") passed June 10, 1857, provided also for the Election of nine Directors in the same manner.

The same Act provides for the amalgamation of the two Companies; after which the respective Directors of the two Companies "shall be the Directors of the Company formed out of the said amalgamated Companies until the then next election of Directors," &c.

The Act of December 24th, 1870, granting two million acres of timber lands to the Company, provides that: "the Lieutenant Governor in Council, shall have the appointment of one third of the Directors of said Company, without counting the *ex-officio* Directors, or Directors representing municipalities," &c.

The Act of December 24th, 1870, extending the period for completing the Railway to May 1st, 1877, provides that: "The Board of Directors of said Company shall be composed of twelve members in addition to the representatives of the municipalities entitled to form part thereof. Of these twelve members, four shall be named by the Lieutenant-Governor in Council, eight only in future to be elected by the shareholders."

The same Act authorizes the Council of the City of Quebec to subscribe one million dollars to the capital stock of the Railway Company; and "to be represented at the Board of Directors by the Mayor and three other members appointed by the Council."

The Mayor of the City of Three Rivers had also become *ex-officio* director, by virtue of a subscription by that City of one hundred thousand dollars. And the Mayor of St. Sauveur had also become *ex-officio* director, by virtue of a subscription by that municipality, of ~~one hundred~~ ^{thirty} thousand dollars.

The Board of Directors at that time and until further legislation, was therefore composed of eighteen members, as follows: Eight elected by the Stockholders; four named by the Provincial Government; four from the City of Quebec; one from the City of Three Rivers; and one from St. Sauveur.

The "Quebec Railway Aid Act of 1874," passed February 5th, 1874, which withdraws all of the previous land grant, except "Block A"; and substitutes therefor, a debenture or money loan of \$1,248,634, provides that: "The Board of Directors of the Company shall be composed of twelve members, in addition to the representatives of the municipalities entitled to form part thereof. Of these twelve members, six shall be named by the Lieutenant-Governor in Council, and six only shall, in future, be elected by the Shareholders and Bond-holders, in the manner hereinafter provided." Also that: "In the election of Directors of the said Company on the 20th May next, and at all elections thereafter, each Shareholder shall be entitled to one vote for each one hundred dollars of Stock held by him, upon which at least 10 per cent shall have been paid up, and upon which all other subsequent calls shall

also have been paid up. And each person holding bonds or debentures of the said Company, issued under section seventeen of this Act, shall be entitled to one vote for each hundred dollars of bonds or debentures so held by him ; and such Shareholders and Bond-holders shall be entitled to vote either in person or by proxy. "

The last named Act being now in force, it will be seen that the Board of Directors is now constituted of eighteen members, as follows : Six elected jointly by the Stock and Bond-holders ; six named by the Provincial Government ; four from the City of Quebec ; and one each from the City of Three Rivers and St. Sauveur.

It will also be observed that twelve, or two-thirds of the members of the Board, who hold the office, either *ex officio*, or as representatives of the Provincial and Municipal Governments, are liable to be changed or superseded, either at long or short intervals, as the case may happen to be, by any change that may occur in the administration of which they are, for the time being, the representatives ; so that it would appear from the nature of the case, to be quite improbable, if not impossible, for the Board of Directors to adopt any decision, or line of policy, that could be considered as permanent ; or at least, not liable to be departed from at some future time.

For example, during the past two years, the Government Directors sitting at the Board, have represented three separate and distinct organizations of the Provincial Government ; and the Quebec City Directors sitting at the Board during the same time, have represented two distinct organizations of the City Government ; and the same with Three Rivers and St. Sauveur ; and, so the changes are likely to continue for an indefinite length of time.

The consequence is, that there are only ~~seven~~^{seven} members of the present Board of Directors, who were members when the original contract, for the construction and equipment of this Road, was entered into, on the 5th April, 1872 ; and only twelve members of the present Board, who were members when the supplemental contract was entered into, on the 21st February, 1874.

It also appears, that another and most potent element is hereafter to be introduced into the organization of the Board, by virtue of the provision in the present " Railway Aid Act," which allows the Bond-holders to vote for Directors.

When this power shall be exercised, it is not at all improbable that the only remaining link between the present and the past will be entirely severed, by the displacement of the Directors who have heretofore been elected by the original stock-holders.

While it must be admitted that this state of things is not calculated to insure that harmony of action, and adherence to any fixed and settled policy, which are always considered quite essential to the success of an important enterprise of this kind ; it is by no

means conceded that it lessens the obligations of the Board at any one time, to carry out in good faith, such obligations and understandings as the same body, although differently constituted, or composed of different members, may have entered into at any previous time.

Neither, is it conceded that either the Provincial Government, or the City Council of Quebec, can consistently ignore the acts or policy of any one set of their respective representatives in the Board, by the subsequent approval of an entirely different and perhaps *antagonistic* policy, on the part of another and more recent class of representatives.

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II. CONNECTION OF THE PRESENT CHIEF ENGINEER WITH THE ROAD.

In view of the fact, that but a small minority of the Members composing the present Board of Directors, are at all familiar with the circumstances under which I first became connected with this Road, I propose, as a matter of history, as well as in justice to myself, to refer quite briefly, and without intentional egotism, to some of the more important events which preceded, as well as followed, my appointment as Chief Engineer, up to the date of the present supplemental contract.

In the month of September, 1870, Mr T. C. Durant, of New-York, with whom, as Vice-President and General Manager of the Union Pacific Railroad, I had been associated as Consulting Engineer, during its entire construction, invited me to accompany him to Montreal, Three-Rivers and Quebec, for the purpose of looking into and obtaining information respecting the merits of the North Shore Railway and Piles Branch, together with the land grants which had been appropriated by the Government in aid of the enterprise.

After spending several days in the above investigation, accompanied by Hon. Wm. McDougal, Mr. Willis Russell, Mr. P. B. Vanasse and others, we returned to New-York with a very high appreciation of the value and importance of the undertaking.

During the following Spring, I was called upon, at my office in New-York, by Col. Wm. Rhodes, Director, and Mr. Dunn, Treasurer of the North Shore Railway Company, who informed me that they had been requested by the Board of Directors, to see me with reference to taking charge of the road as Chief Engineer; and, if my engagements would not permit of my doing so, to ask me to recommend a competent Engineer for the position. Col. Rhodes called upon me several times afterwards, upon the same business.

In the month of May 1871, I again visited Quebec in the interest of Dr. Durant, for the purpose of satisfying both him and myself, as to whether there was sufficient vitality in the enterprise to justify us in taking hold of it at that time; after spending several days here, I informed the President, Col. Rhodes, Mr. Russell, and such others of the Directors as I happened to meet, that if they would come to New-York with proper data and authority, I thought they might close an arrangement with Dr. Durant for constructing the road.

On the 8th July, 1871, a Committee of Directors composed of the President, Hon. Jos. Cauchon, and Messrs Irvine, Rhodes, Russell and Taschereau, Directors, visited New-York with the

maps and profiles of the line ; and on the 13th, closed an arrangement with Dr. Durant, by which he was to furnish the means required for making a new survey of the road. It was also arranged that I should come here and direct the surveys in behalf of the Railway Company.

On the 20th July, Dr. Durant informed me, in New-York, that he could not keep his engagement with the North Shore Railway Committee ; and advised me not to come to Canada. I started, however, on the same evening for Quebec, in accordance with my agreement, arriving here on Saturday, July 23, 1871.

The President and Directors were very much disappointed and disheartened upon my notifying them of Dr. Durant's decision ; but requested me to drive over the line, and inform them whether I could aid them in procuring the necessary means for constructing the road.

Upon returning to Quebec, after examining the capabilities and resources of the country, I informed the President and Directors, that if they could raise the means among themselves for a re-survey of the line, so that I could have reliable data upon which to base an estimate and report, I had no doubt that I could induce some of my friends, whom I knew to possess the necessary experience and capital, to undertake the construction of the road : provided the Company would appropriate for that purpose, its land grant, the one million dollars of City subscription, and the one million dollars of Municipal subscriptions which the Directors felt quite sure of obtaining from the Counties and Parishes along the line.

The members of the New-York Committee accordingly met in Quebec, on the 28th July, and agreed to raise five thousand dollars among themselves, towards defraying the expenses of the survey ; and also authorized me to open negotiations with responsible parties, for the construction of the road ; and also, to re-survey the line. Which action, as I have always regarded it, was the important and decisive step which finally resulted in placing the construction of the road beyond the reach of any ordinary contingency,

After spending some days with the President, Hon. Jos. Cauchon, Hon. J. J. Ross, Hon. Wm. McDougall, and Mr. Willis Russell, Directors, in visiting the counties west of Three Rivers, with a view of creating some enthusiasm about the road, I went to Chicago for the purpose of meeting some parties from Wisconsin, with whom I had already opened a correspondence with reference to constructing the road. Failing to meet these parties according to appointment, I was induced to open a negotiation with Messrs. P. H. Smith, George L. Dunlap and Samuel L. Keith, of Chicago ; which resulted in a proposition on their part, to construct and equip the road upon the basis above referred to ; which proposition was afterwards accepted by the Railway Company.

A complete survey was also made of the line, during the Summer and Fall of 1871, with a view, mainly, of inducing the Counties and Parishes along the line, to subscribe to the Stock of the Company; but owing to a defection in the County of Champlain, the entire subscription failed; and it was therefore thought for a time, that there was no further present hope for the road.

During the following February, however, I succeeded in bringing the parties together again in New York, for the purpose of renewing the negotiations upon the then diminished basis of the Company's assets; which negotiations terminated in a renewed agreement on the 13th of February; and the signing of a final contract by the parties, at Quebec, on April 5, 1872.

It is proper to mention here, that the *specifications* attached to contract had previously been carefully examined and approved by a special committee appointed by the board for that purpose, consisting of Hon. Joseph Cauchon, President, Hon. Geo. Irvine, Solicitor - General, and Government Director, His Worship (P. Garneau) the Mayor of Quebec, H. T. Taschereau, City Director, and J. B. Renaud, stock-holders Director. A majority of whom, as will be observed, were representatives of the Provincial Government, and city of Quebec.

The contract and specifications had been prepared by myself with very great care, after a very extensive and varied professional experience upon many of the most important *first class railways* in the United-States; and after a careful examination of the specifications of other works with which I had not been connected; and they were made, as I then believed, and still believe, to conform both in spirit and in substance, to the specifications under which the New-York and Erie, the Chicago and North-Western, and the Union Pacific Railways were constructed, which aggregate nearly three thousand miles in length, and are all regarded as fully up to the United-States Standard of *first class Railways*.

The Government Standard, under which the Union Pacific Railway was constructed, together with extracts from the opinions of several of the most eminent Engineers in the United-States, who were consulted upon the subject; also extracts from the specifications of the Erie, the Chicago and North-Western, the Montreal Northern Colonization, and the North Shore Railways are annexed hereto, for convenient reference, and marked "Appendix No. 1."

Every suggestion that was made, however, by any member of this Committee (and several were made by the Mayor of Quebec) were incorporated into the specifications; and they were unanimously approved by the committee; and subsequently by the Board of Directors in connection with the contract.

It may also be proper to mention, in this connection, that during the negotiation of this contract, my salary as Chief Engineer, which had not been previously decided upon, became the subject of discussion between the Contractors, the Committee and myself; and it was then fully agreed and understood, that it was to be fixed at ten thousand dollars per annum, exclusive of travelling and incidental expenses, during the construction of the Road.

It was very well known to the Contractors, that during the previous several years, I had been receiving compensation for my professional services, in the United States, quite equal to that amount per annum; and they therefore expressed themselves as being quite pleased as well as surprised, that I was willing to sever my business connections in the States, and to accept so moderate a salary, particularly when the important services which I had rendered to themselves, as well as to the Railway Company, were taken into consideration.

During the year 1872, the entire line was resurveyed, and located with reference solely to obtaining the best Engineering route "of which the capabilities of the country would reasonably admit" as provided for in the contract.

The maps, profiles and grades of the above location were thoroughly examined and unanimously approved by the Board of Directors, from the City of Quebec to "the East End of Section No. 132," by Resolutions passed August 8th and October 10th 1872.

In arranging the grades upon these profiles, it was done, as stated in my report of October 10, 1872, "with particular reference to the avoidance of cuts which would be likely to become filled and blockaded with snow, during the winter season;" they were, as a general rule, placed at least 20 per cent higher, than had been my previous practice, and than the strict rules of economy in construction would justify, in order to meet the difficulties apprehended from snow; and the gross quantities in Road-bed of excavation and embankment, as computed at the time, showed that the embankment exceeded the excavation by more than 80 per cent.

An examination of the present and former profiles will also show, that the *Top rail line* will be at least *three feet* above the natural surface of the ground, upon from 70 to 80 per cent of the entire distance between Quebec and Montreal; and whenever the embankments are made from side excavations, the adjacent surface will necessarily be depressed from two to five feet, in order to obtain the requisite material; which, so far as *snow obstructions* are concerned, will be the same in effect, as raising the bank to that extent.

The work of construction was also commenced during the summer of 1872, from the City of Quebec, westward, and several miles of grading completed.

In the meantime I had prepared full detailed reports, respecting the probable cost and future earnings of the road; and also, of the value of the Company's land grant, with a view of enabling the Contractors to place the securities of the Company upon the market at the proper time.

Two of the Contractors, Messrs. Dunlap and Smith, sailed for Europe, on July 20, 1872, for the purpose of placing these securities upon the market; and remained there until the summer of 1873. At their request, I left Quebec on the 28th February, 1873, with full Maps, Profiles, Reports and Estimates of the line; and joined them in London on the 13th of the following March.

I remained in London until the 14th of May, and then returned to Quebec, for the purpose of obtaining an important modification of the contract, on the part of the Railway Company. I arrived here on the 25th May; and on the 7th of June, called to the Contractors in London, that the Company had acceded to the modification of the Contract.

Soon after my return from Europe, my attention was directed to some anonymous articles, which had appeared in the newspapers of Montreal and Quebec, derogatory to the character of the North Shore Railway; and hinting that the Chief Engineer was in complicity with the Contractors &c. These articles were referred to and answered by the Chief Engineer in a Report "to the New Board of Directors," under date of May 28th 1873, from which the following are extracts:

"The statements contained in the newspaper articles referred to, and which were extensively published during my recent absence in Europe, for the evident purpose of prejudicing the minds of the new members of the present Board of Directors against myself, as the Engineer of the Company, as well as against the Contractors who have undertaken to build the road, seem to justify if not demand a more extended notice."

"I deem it exceedingly fortunate that at this the first meeting of the present Board of Directors, I am permitted, as an act of justice to myself, and duty to the Board, to make such explanations with reference to the contract, and such a vindication of my own position in connection with it, as will, if believed by the Board, exonerate me from the charges and insinuations contained in these articles."

"The Northern Colonization Company may therefore regard themselves as exceedingly fortunate if they succeed in constructing and equipping their railway upon as favorable terms as those embraced in the present contract for the North Shore Railway."

"With reference to the above direct charge of complicity or

collusion "with the American Contractors at the expense of the Province," as well as of the Railway Company, I can only say that it has never been my practice to answer newspaper attacks made either upon my integrity or ability as a Civil Engineer."

"If a tolerably long and active life devoted entirely to the profession, upon some of the most important works of public improvement upon the American continent, has not secured for me a reputation that is above and beyond any injury that can be effected by the publication of cowardly articles of this kind, it would certainly be useless for me to attempt to bolster it up by any other means, at this late day in my professional life."

"It may not be out of place, however, to enquire at the present time, why Mr. Legge, "*the astute, clever, and experienced Chief Engineer of the Northern Colonization Railway*," as he is called in the article referred to, or some other of the "*eminent Canadian Engineers in whom the public have confidence*," have not, during the past twenty years in which the North Shore Railway has been in a languishing and almost dying condition, discovered its peculiar merits as "*the first link in the Great Northern Railway, to extend at no distant date from one end of our Province to the other*," as is very justly claimed by the article referred to; and have not by their reports and representations in its favor, induced Canadian contractors to undertake its construction, and thus reap for themselves the enormous benefits that it is claimed will accrue to American Contractors, who, at this late day, and almost solely upon my estimates and representations, have in good faith undertaken to construct the road.

"I have deemed it proper to make the foregoing statements in defence of the previous policy of the Company as connected with the present contract, in order that the members of the present Board, who are not entirely familiar with the past history and present condition of the Company, may act intelligently and without prejudice upon the important proposition which is now before them."

The matters referred to in these communications, however, soon became a subject of discussion in the Board of Directors; and afterwards resulted in a correspondence between myself and several of the most prominent Engineers in the country, respecting the "class" or character of Railway called for under the provisions of the contract and specifications; all of which was duly reported to the Board on the 14th July, 1873, by order of a resolution of the Board to that effect.

The work of construction was not resumed by the Contractors in 1873, although some Engineering was done, at different points upon the line, with a view of improving the previous location, which changes were also approved by the Board.

III. REVIEW OF PRINCIPAL EVENTS SINCE THE TRANSFER OF THE ORIGINAL CONTRACT.

On the 12th of January, 1874, the original contract was transferred by the Chicago Contracting Company, to Hon. Thomas McGreevy, of Quebec, for a very large bonus over and above past expenditures; it being distinctly understood at the time, (as I was subsequently informed by both parties,) that no change was to be made in the Engineering organization, in consequence of this transfer.

The transfer of the contract was afterwards duly recognized by the Railway Company; and a supplemental contract was entered into with Mr. McGreevy, on the 21st of February, 1873, in which was embodied the provisions of the "Railway Aid Act"; which had, in the meantime, been enacted by the Provincial Government.

The provisions of the "Act" above referred to, changed the nature of the "Aid, granted to the road by the Provincial Government, from a land to a money subsidy, to such an extent that the Board, through the recommendation of a Committee, consisting of the President, Col. Wm. Rhodes, Hon. George Irvine, Attorney-General, and Government Director, Hon. P. J. O. Chauveau, Government Director, the Mayor of Quebec, (Hon. P. Garneau), the Mayor of Three Rivers, (Mr. Normand), Mr. Weston Hunt, City Director, and Mr. Andrew Thomson, Stock holders Director, unanimously agreed with the present Contractor upon a supplemental contract, which provides for an expenditure on his part, of *several hundred thousand dollars* more than was provided for in the original contract.

It will be observed that the above named Committee consisted of a large majority of Government and City Directors.

It will also be remembered that the expediency of providing for a higher class of road than, it had been claimed, by outside parties, was contemplated by the original contract and specifications, was fully discussed both in the Committee, and in the Board; and that it was concluded that the "correspondence" above referred to, and then before the Board, had placed that matter upon a satisfactory basis.

After placing the administration of his contract in the hands of his brother, the Hon. Thomas McGreevy left for Europe, on the evening of the same day, 21st February; and he returned to Quebec on 2nd of May following; having, as he then informed me, and reported to the Company, completed all the financial arrangements necessary for a vigorous prosecution of the work.

The principal events which have occurred since the return of the Contractor from Europe, are so fresh in the minds of most of the present Directors, that I deem it quite unnecessary to refer to them here, except to state generally, that the Engineering organization had been placed upon a basis barely sufficient to enable it to meet the requirements of re-tracing the entire line between Quebec and Montreal, which had become totally obliterated since it was originally located; and to make such changes in the details of the former location as seemed expedient, both for the good of the work, and economy in construction; and also, to lay out the work and supervise the construction upon that portion of the line between Quebec and Three Rivers, upon which, only, the Contractor has commenced operations.

The progress of the work upon this portion of the line, up to the close of the past working season, was duly reported to the Board on Dec. 21st 1874, a copy of which report, together with a copy of a letter addressed to the Secretary, on the 12th Jan., 1875, which has an important bearing upon this subject, are annexed hereto, marked "*Appendix No. 2*,"

The orders of the Engineer, respecting the execution of the work have been complied with by the Contractor, as a general rule, the most important exception being with reference to the Ste. Annes River Bridge, the correspondence in relation to which is annexed hereto marked "*Appendix No. 3*."

The earth-works have been commenced and carried on upon the theory of a not less than *twelve feet width of road-bed*, at the base of the cross-tie, or superstructure of the track; and from fourteen to fifteen feet, according to height, nature of material, &c., at the base of the ballast, whenever in the opinion of the Engineer, the native material "is unsuitable for sustaining the permanent track."

These works, however, were, as a general rule, left in a very rough and unfinished state, at the close of the past working season; very few of the excavations or embankments having been carried out to the requisite widths, or brought to the required top-grade or sub-grade line, as the case might be.

The material in cuttings has also, in many cases, been temporarily thrown upon the sides, with a view hereafter of hauling it into the adjacent banks, or using it for ballasting the track.

In a contract of the kind under which this road is being constructed, where the consideration named is a *lump sum* for the final execution of the work in the manner and within the time therein specified, it has not been assumed that the Engineer could consistently direct the *order* in which certain details of the work should be executed, unless in his opinion the present safety or future permanency of certain works or structures should require

the exercise of this power, as for instance in the case which has already been referred to, of crib and pile foundations in deep water.

The principal Contractor has therefore generally been allowed, through his sub-contractors and agents, to commence and carry on the work at his own discretion; the Engineer in the mean time endeavoring to see that the work, when done, was properly done; and also that the quantities returned for the monthly or progress estimates, were certified upon a proper basis to secure the ultimate completion of the work, in accordance with the terms of the contract, and the requirements of the specifications.

The masonry thus far constructed, consisting of one finished pier at the Jacques-Cartier River, several unfinished bridge abutments, the commencement of two piers at the Port-Neuf River, and several box culverts along the line, is all *first class* in character, for the purposes designated; and no question has thus far been raised by the Contractor respecting the character of masonry required to be constructed, except in the case of one box culvert laid in cement, which the Contractor thought should have been laid dry; and also as to whether a portion of the bridge masonry could not be laid in *lime* instead of *hydraulic cement mortar*, as specified in the contract.

In fact ~~the~~ the Contractor succeeded in getting a small quantity of *lime mortar* into the Jacques-Cartier pier, during the absence of the Inspector upon an adjoining piece of work. Upon the matter being brought to my notice, after several courses of *cement* work had been laid over the *lime*; and upon being assured, both by the Inspector and the Assistant and Resident Engineers, that the lime mortar had been used only in two or three courses, near the center or heart of the pier, I permitted the word to go forward.

While speaking of this particular pier, it may be proper to explain, that the thickness of 4 feet 6 inches at top *under the coping* was originally designed for an abutment for the support of the west end of a single truss spanning the River; under which arrangement it was designed to construct a few short spans of trestle work, to clear some mill races, and connect with the bank, above high water mark, upon the west side of the River; but at the special request of the Contractor, an additional truss was afterwards substituted for the trestle work; and as the masonry had been commenced, and as I had no doubt as to its requisite strength, I did not consider it worth while to change its dimensions.

IV. DIFFERENCES BETWEEN THE CONTRACTOR AND THE CHIEF ENGINEER RESPECTING THE TRUE INTENT AND MEANING OF THE CONTRACT.

The Contractor has constantly and persistently insisted upon his right under the contract, to control the organization, appointments, and salaries of the Engineering Staff. And the Chief Engineer has with equal persistence resisted this construction of the contract.

An appeal to the Board of Directors however, has resulted in a reluctant consent on the part of the Contractor to pay the Engineering expenses, up to the 1st of December last, since which time he has neglected or refused to pay these expenses, in consequence of which every one connected with the Staff is suffering from financial embarrassment.

This vexatious subject has given rise to an extensive correspondence between the Contractor and Chief Engineer; and also to several communications from the Chief Engineer to the Railway Company, all of which are quite familiar to the Board of Directors, and therefore no further allusion need be made to the subject here, except perhaps to refer to a pamphlet, entitled "*Views of the Engineer in Chief*", dated July 16th 1874, and another entitled, "Review of Engineering expenses, past, present and prospective, by the Chief Engineer," dated February 2nd 1875, which are now in the hands of the Secretary.

An extract from the last named pamphlet headed "Statement of Engineering expenses upon the Main Line, up to Dec. 1st 1874" is however annexed hereto for convenient reference, and marked "*Appendix No. 4.*"

A very decided difference has also been found to exist between the views of the Contractor and the Chief Engineer, respecting the power of the Chief Engineer, subject to the approval of the Board, to change the line, grades and plans of the work; and also the Schedules upon which the monthly estimates are based, during the construction of the road, without the consent of the Contractor.

The views of the Chief Engineer upon this important subject, having been presented to the Board in printed form, under date of January 30th 1875, no further allusion will be made to them in this place.

The Contractor has also raised a question as to the binding force of "Circular No. 2," dated June 12th 1874, which was intended to

DIFFERENCES AS TO CONSTRUCTION OF CONTRACT. 15

meet in detail, certain requirements of the general specifications respecting the character of the work ; but no controversy has yet arisen respecting the general character, or proper execution of the work therein referred to.

The foregoing, I believe, comprises, substantially, all the differences of a serious nature, which have arisen between the Contractor and the Chief Engineer, respecting the true construction of the contract, up to the present time.

It is quite true that a voluminous, and I regret to say, somewhat acrimonious correspondence has been carried on, during the past few months, between the Contractor and the Chief Engineer principally through the medium of the Company, respecting matters of a more personal nature than it would be proper to treat of in this report.

V. THE CLASS OF ROAD, AND CHARACTER OF WORK ALREADY EXECUTED.

Differences of a very serious and embarrassing nature having arisen between the Provincial Government and the City Council of Quebec, on the one part; and the Railway Company and the Chief Engineer on the other part, which if not removed or harmonized, must inevitably result, either in an entire suspension of the work, or in the negotiation of a new contract, it seems important that this branch of the subject should be considered with especial care and attention.

With a view to a full understanding of the questions at issue, it will be advisable, to retrograde somewhat, in order to see the relations which actually exist between the respective authorities above referred to, and the Railway Company.

Reference has hereinbefore been made to a land and money grant, or subsidy, given by the Provincial Government in aid of the road, by virtue of which the Government appoints six of the eighteen members of the Board of Directors of the Railway Company; and reference has also been made to a subscription to the Capital Stock of the Company, in the City Council of Quebec, by virtue of which the City is represented in the Board by four Directors; thus giving the Government and the City a joint majority of *three votes* upon any question or division that may be brought before the Board.

The act of December 24th 1870, granting lands by the Government in aid of the road; provides that these lands shall be so granted when: "The said railway shall have been completed and put in operation to the entire satisfaction of the Lieutenant Governor in Council."

"The Quebec Railway Aid Act of 1874," provides, that the subsidy or loan of one million two hundred and forty-eight thousand, six hundred and thirty-four dollars, shall be granted upon the condition that:

"The main line of said railway shall be a first-class road, and shall have been accepted as such by the Lieutenant-Governor in Council, on the report of the provincial railway board."

The same act also provides that:

"Notwithstanding anything to the contrary contained in this act, it shall be lawful for the Lieutenant-Governor in Council, on satisfactory proof that the Montreal Northern Colonization Railway Company, or the North Shore Railway Company, have made complete financial arrangements, or entered into contracts in good

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faith, for the construction of their respective lines of road, and that the work thereon is in active progress, to advance, from time to time, unto either or both of such railway companies, out of the grant or loan, to which they would be entitled under this act, a sum bearing such proportion to the total amount of the grant authorized herein, as the progress of the work, and the security taken by the Companies, for the completion thereof, may then seem to the Lieutenant-Governor in Council to justify."

One of the original conditions upon which the City Council of Quebec agreed to aid the company is as follows :

" 4. The Corporation shall issue their capital according to the progress of the work, and *pro-rata* to the total cost of said road between Quebec and Montreal, on certificate of the Engineer to be named by themselves."

Upon the return of the Contractor from Europe, in May, 1874, he represented to the Railway Company that, in order to enable him to perfect his financial arrangements in Europe, he would require that a portion of the Government and City aid, should be granted in larger proportions to the actual expenditure, during the early stages of the work, than had previously been provided for.

Therefore, upon the application of the Railway Company to the Government, the following order in Executive Council was passed on June 27, 1874.

" 1. That the Government should issue to the said Railway Company the bonds of the Province for one third of the cash value of the work done on the said Railway as the work progresses, the other two thirds to be paid by the bonds or stock certificates of the Corporation of Quebec, and the bonds of the said Railway Company in equal proportions.

2. The amount of such cash value of the work, to be ascertained by the certificate of a Railway Engineer to be appointed by the Government.

3. The above mentioned advances to be made in proportion of one third, to the extent of \$500,000, provided the Government continues to be satisfied with the progress of the work, and afterwards to be continued in the proportions which will then be determined upon."

Upon the same application being made to the City Council of Quebec, the following Resolution was adopted on July 21, 1874.

" *Resolved*.—That this Council do prepare bonds to the amount of five hundred thousand dollars, being one half of its subscription to the capital stock of the North Shore Railway Company, the said bonds to be delivered to the said Company at par by the Corporation of Quebec, on the certificate of a competent Engineer to be named by this Council, in the proportion of one third ($\frac{1}{3}$) of the actual cost in money of work done, as certified in each estimate

by the said Engineer; on condition, however, that the Government and the said Company shall continue to pay in the same proportion. And in the event of the Government ceasing to pay its share of its subscription as above stated, this Council shall have power to stop issuing any more bonds in favor of said Company and further, that no progressive estimate of the Engineer named by the Corporation shall be recognised or paid by this Council, unless permanent works have been really commenced and continued within the limits of the City of Quebec."

"That all the other conditions relating to the said subscription by this Council of one million dollars towards aiding the construction of the said North Shore Railway between Quebec and Montreal remain unchanged, in full force and effect as heretofore."

It will be observed that, under the acts granting Government aid to the road, no provision was made with reference to the "certificate of an Engineer," the only requirement being, that the road would be constructed "to the entire satisfaction of the Lieutenant-Governor in Council," so far as the *land grant* was concerned; and "that it should be a *First Class Road*, and shall have been accepted as such by the Lieutenant Governor in Council, on the report of the Provincial Railway Board;" so far as the money grant was concerned.

It will also be borne in mind, that at the date of the original contract, April 5th 1872, the only condition on the part of the Government, was the one with reference to the *land grant*; and that no condition respecting the certificate of a Railway Engineer to be appointed by the Government, had been imposed upon the Company, until June 27th 1874, at which time the line had been located, the grades established, the width of earth works designed, and the work of construction going forward between Quebec and Three Rivers, all of which had been, and was being done, under the approval of a Board of Directors, a majority of whom were the legal and responsible representatives of the Provincial Government, and the City of Quebec.

Both the President and the Chief Engineer, of the Railway Company had, since the date of the original contract, made frequent and urgent application to the Mayor and other City Directors upon the Board, to have an Engineer appointed on the part of the City, who would indicate his views upon important matters connected with the plans and details of the work, in time to avoid any future and perplexing questions that might arise upon these points; but no such appointment was made until after an expenditure of nearly a half million dollars had in good faith been made upon the road.

The same views were also urged upon the members of the Board who were representatives of the Provincial Government, so soon

as it was ascertained that the payment of a portion of the subsidy provided for under the order in Council, dated July 21, 1874, required that the amount of such payment would be subject to "the certificate of a Railway Engineer to be appointed by the Government;" but the appointment of the Government Engineer was deferred until work had been suspended for the Winter; and therefore, when he did finally examine the work, it was done over a portion of the distance in a driving snow storm; and over the remainder of the distance, with several inches of snow upon the ground; circumstances under which I claim, that it would be impossible for any one to form an intelligent opinion respecting the real character and condition of the work.

It is but just to state, however, that the City Council of Quebec promptly ordered the payment of the amount (\$112,000) which the City Engineer certified as being due to the Company under the resolution above referred to.

It should also be stated that the Provincial Government took early steps to secure the services of Mr. Walter Shanly as Inspecting Engineer upon this road; and it was hoped by all parties that the effort would succeed; but most unfortunately, when Mr. Shanly received the appointment, he found that it embraced also the inspection of the Montreal Northern Colonization Railway, and he therefore peremptorily declined the situation.

Having thus failed to comply with the just expectations of the Company, and the Contractor, respecting the appointment of an Engineer; and having become satisfied from other sources as to the amount expended upon the road, the Government very promptly and properly advanced \$80,000 *on account*, in September last, subject to further adjustment.

During the latter part of October or early in November, the Government appointed as Inspecting Engineer Mr. A. L. Light, a member of Mr. Sandford Flemir's Engineering Staff, upon the Interecolonial Railway; who accepted the appointment very promptly, and entered upon his duties as above mentioned.

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VI. THE PRESENT SITUATION.

Having thus brought the history of successive events down substantially to the present time, I will proceed, as briefly as possible, to state the present condition of affairs.

The Government Engineer has made two reports upon the character of the work already done upon this road.

In his first report, dated 25th November, 1874, immediately after his trip over the line before referred to, he says:

"The works generally are well done, with some exceptions, afterwards mentioned, and in accordance with the specifications, and progressing in a satisfactory manner."

"The question whether the works are substantial and permanent in character *in all respects*, can be answered in the affirmative, with two exceptions, viz: the earth works constituting the road-bed are insufficient, although in accordance with the profiles."

"*The inclination of the gradients is generally all that can be desired, but they are laid too low.*"

In his second report dated January 12th 1875, more than six weeks after the date of his first report, the Government Engineer, without having made any subsequent inspection of the line, proceeds to state categorically "*five additional reasons*" for considering the North Short Railway, not first class, neither of which reasons are specified or referred to in his original report.

In another report (of which I have not the date, but probably written about the same time) upon the "Montreal Northern Colonization Railway," the same Government Engineer, in speaking of the Engineering Expenses upon that road says:

"This compares favorably with similar expenses on the North Shore Railway, where these three items to date amount to about \$180,000, while the value of the work done is but \$220,000, *the Engineering being about 86 per cent on the actual outlay for work done.*"

As I have had the honor of laying before the Board full replies to the multiplied objections raised by the Government Engineer to the class of work upon this road, under date of January 9th, and January 26th 1875, it will be supererogatory to repeat them here; but as I have had no previous opportunity of noticing the extraordinary statement respecting this road, which he has volunteered to make in a report upon an entirely different road, I will merely remark, that a reference to the "Statement of Engineering expenses upon the Main Line up to December 1st 1874,"

hereto annexed, and marked "Appendix No. 4," will show that *his statement has no foundation in fact.*

It will answer my present purpose to state, that these reports of the Government Engineer, caused a feeling of distrust on the part of the Government with reference to the character of the work already done, and the amount of money that had been properly expended upon the road; while at the same time they could but produce a feeling of doubt and anxiety in the minds of many of the Railway Directors, respecting the professional ability and integrity of the Chief Engineer, under whose advice, the original contract and specifications, had been prepared and adopted, and the subsequent location and grades of the line had been approved; and under whose immediate direction and supervision, the plans have been prepared, and the work thus far executed.

The Government immediately calls the attention of the Railway Company to the subject; and states, in effect, "although the certificate of our own Engineer shows conclusively that at least \$110,000 is due to the Company, of which the Government had already paid \$80,000 yet we will not pay you the balance until we know, *what you are going to do about it.*"

The members of the City Council of Quebec say, "although we have paid the Company \$112,000 as certified by our Engineer upon the supposition that every thing was all right, yet we will not vote to pay another dollar until we know, *what you are going to do about it.*"

The Railway Company reply to the Government, that they will proceed to rectify matters immediately; and then turn to the Chief Engineer and say, it seems that you have been the cause of all this difficulty, by your loose and imperfect contract and specifications; and by the improper manner in which you have devised your plans and superintended the work, *what are you going to do about it?*

The Chief Engineer replies, "I confess to having been the principal agent in the matter, and will therefore try and see *what can be done about it.*"

The Contractor coolly places the money which he has received from the Government and the City in his capacious vaults, turns to the poor Engineers, who are waiting at his door for *three months pay*; and inquires "*what are you going to do about it?*"

It was finally decided by the Railway Company, with the assent of the Government, the Chief Engineer, and the Contractor, to call in another Engineer, and see what he would advise all parties to *do about it.*

Telegraphic communications were immediately opened with Mr. Walter Shanly at Montreal, and with Mr. Sandford Fleming at Ottawa, in order to ascertain whether they would come and tell us, *what to do about it.*

Mr. Shanley, although urgently requested to do so, both by letter and telegraph, felt obliged to decline the service, on account of other and more pressing engagements.

Mr. Fleming at first requested that the case should be brought to him at Ottawa. But after the final declension of Mr. Shanley; and upon being further urged, he consented to come to Quebec, without however having received the least intimation as to what he was coming to Quebec for.

Upon reaching Quebec and learning the state of the case, Mr. Fleming discovered that he had previously formed and expressed a very decided opinion, a printed copy of which was now in possession of the Company, upon several of the most important questions that were to be submitted to him; and he therefore very properly and honorably informed the Board, that he could not act in the matter unless with the full consent of the Chief Engineer, whose opinion as to the character of work called for under the existing contract and specifications, he had already found to differ so entirely from his own.

The Chief Engineer was immediately called before the Board and again asked, *what he was going to do about it?*

Feeling quite satisfied in his own mind, that the work already done upon the road, was fully up to the required standard; and believing also that the contract and specifications, as amplified and explained by "Circular No. 2," which had not been examined by Mr. Fleming; but which had been prepared in pursuance of the powers which Mr. Fleming had previously decided were delegated to the Engineer under the Contract, would effectually meet and cover the objections which he had previously raised respecting the future class of the road, as well as his assumed vagueness and ambiguity of the specifications; therefore, after a full and explicit understanding with the Board of Directors, to the effect that Mr. Fleming's opinions upon the various matters to be submitted to him, would be regarded as *only advisory*, so far as they related to the subject upon which he was already committed; and also that the Board in taking final action, would give due consideration to the fact of his having so committed himself; and also to the fact that Mr. Fleming's previous practice had differed so widely in many respects from that of the Chief Engineer; feeling also quite unwilling to assume the responsibility which had been placed upon his shoulders, by the action of Mr. Fleming, in creating further delay in the decision of matters which were of the most pressing importance to the Railway Company, whose servant he is, the Chief Engineer felt impelled to give his full consent that Mr. Fleming should enter upon and perform the very responsible duties which had been assigned to him.

Mr. Fleming entered upon his duties at once, and collected all the information he could here, during the two days which he had allowed to himself for that purpose, after which he returned to Ottawa, and prepared his report.

Mr. Fleming's report, dated February 10, 1875, has now been before the Company and the Government several weeks, and no decision has yet been reached as to *what will be done about it*.

He decides every question at issue between the Contractor and the Chief Engineer, herein before referred to, in accordance with the views always entertained and submitted to the Company by the Chief Engineer, except as to the binding force of "Circular No. 2," in regard to which he says: "I have *grave doubts* as to some matters therein referred to, being fully authorized by the contract."

His views respecting the *class or character of road* called for under the contract and specifications, remains unchanged. In relation to this matter he concludes by saying:

"I am decidedly of opinion that the expression, *First class Railway*, is not in harmony with the terms of the general specifications. I have already expressed my opinion on this question in letters dated June 11, 1873, and June 23, 1873, addressed to the Chief Engineer, appended hereto; and I have no reason to alter the views then formed."

As to the proper width of earth-works he says:

"The general specifications give 12 feet as the width of road-bed. The amended specifications (Circular No. 2) give 15 feet. The minimum width ordinarily adopted on Canadian Railways, has heretofore been 18 feet, and this has been found barely sufficient. I am perfectly well satisfied that *much less than 17 feet* in the present case, would not be found to give permanent satisfaction."

With reference to the elevation of the top-rail line he says: "it is for long stretches, too low to obviate the climatic difficulties alluded to, and which are met with in this section of the country."

With reference to the plans of artificial foundations, and stone piers, he says:

"This is a matter of opinion in which Engineers may honestly differ; setting aside my own preference, I have no hesitation in saying that, under certain circumstances the plans of artificial foundations, with some modifications, might be advantageously adopted."

"With reference to the stone piers, in my own practice I certainly would have made them heavier than shown on the plans referred to."

With reference to the power of the Engineer to change the plans, profiles, specifications etc., during construction Mr. Fleming says:

"Should the Contractor act on the plans profiles and specifications put in his hands, and make expenditure in preparing material, or in doing work in connection therewith, which would be useless in whole or in part, in carrying out the altered plans etc., the Contractor should be indemnified for loss so sustained. The Com-

pany however should have the power (as already expressed in reply to No. 8), *through the Engineer to change any plans at any time it may appear expedient.*" Also :

"I can see nothing whatever to prevent *any defect in the graduation* being remedied, and I am satisfied from what I have learned, that very little, if *any work already executed*, would be rendered useless *by any change which may now be deemed advisable.*"

The foregoing "extracts" are intended to represent so much of the substance or drift of Mr. Fleming's conclusions upon the particular subjects referred to, as I may have occasion to allude to hereafter.

Upon finding that Mr. Fleming still adhered to his original views upon by far the most important question submitted to him; and the one respecting which I had taken special care to guard the Company from being fully committed; and believing that the opinion of Mr. Walter Shanly, whose experience as a Canadian Engineer had been quite as extensive, if not more so, than that of Mr. Fleming; and whose opinions in matters of this kind would, under all the circumstances connected with this particular case, be entitled to have even more weight and influence, both with the *Government*, and the *Railway Company*, than those of Mr. Fleming, I took the liberty, upon my own responsibility, of again opening a correspondence with him upon the subject, which I am happy to say has elicited from him a very clearly expressed opinion upon all the points submitted to Mr. Fleming.

The correspondence will be found annexed hereto, and marked *Appendix No. 5.*

I would respectfully invite the particular attention of the Board of Directors, and all other parties interested in this road, as well as in the public improvements of Canada generally, to the very able, lucid, and comprehensive views contained in Mr. Shanly's letter, not only upon the particular question submitted to him, but to a general public policy respecting the prosecution of public works.

Believing that Mr. Shanly's position before the country as an able and experienced Engineer; and enlightened, public spirited and progressive citizen of the Province of Quebec, and the Dominion of Canada; and also as a gentleman of irreproachable character and reputation, are such as will command for his opinions the attention to which they are so justly entitled, I will make no further reference to them here, as affecting the questions now under discussion, except to remark that he *fully sustains every position* which the Chief Engineer has heretofore, and at all times taken, with reference to the proper construction to be placed upon the present contract and specifications, and their sufficiency, if properly administered by the Engineer, and faithfully executed by the Contractor, to secure the construction of a *first class Railway.*

I can but regard it as exceedingly unfortunate, that the Government failed in securing Mr. Shanly's services as "Inspecting Engineer;" and this having failed, that the Railway Company did not succeed in securing his services as "Advisory Engineer" in the present important crisis of its affairs.

If the first result had been secured, the *emergency* requiring an "Advisory Engineer" would evidently never have occurred; and this emergency having occurred, if the second result had been secured, it is equally evident that the differences between the present conflicting interests would long ere this, have been fully harmonized; and that *all parties* would now have been working heartily together, under the present contract, for the speedy completion of the North Shore Railway.

Entertaining as I do, a very high regard for Mr. Fleming, both as a brother Engineer, and also as a gentleman; and feeling a sincere desire to place him in a position where he could *consistently* re-consider or modify his views to some extent, upon certain points; and thus secure to the Company the powerful aid of his name and influence, in the midst of its present difficulties, I took, perhaps the *unwarrantable liberty* of opening a further correspondence with him, upon two of the subjects treated of in his report; and of placing before him some views of my own relating thereto, which had been omitted from the statements previously, and *at his own request*, placed in his hands.

But he has thought proper to decline my overtures; and to rest his case upon the report which he had previously submitted to the Company.

From the tone of Mr. Fleming's reply to my letter, I apprehend that the understanding between the Board and myself, with reference to the *binding effect of his opinion upon certain points*, could not have been explained to him; and also, that the reply of the President of the Company to the telegram referred to in Mr. Fleming's letter, (which however I have not seen) may have impressed him with the idea that the *President* did not desire to have the question re-opened.

The further correspondence with Mr. Fleming will be found annexed hereto, marked "*Appendix No. 6.*"

I have also felt exceedingly anxious, as stated in a communication dated Jan'y. 30, 1875, to ascertain the legal construction that the Attorneys of the Company would place upon certain provisions of the contract. With this object in view, I took the liberty on the 25th Feby. last, to enclose to the Secretary some legal points, and to request him to procure such opinion; which correspondence is also annexed, marked "*Appendix No. 7.*"

From the opinions therein expressed it appears, that in a legal point of view, both contract and specifications bind the Contractor

to build a first class Railway; that the Engineer in Chief is delegated with all the powers required to enforce compliance with this condition of the contract; and the views of the Engineer in Chief as to the interpretation to be given, as well to the clauses of the specifications relating to dimensions of road bed; and to his right to issue and enforce the provisions and directions relating thereto, contained in "Circular No. 2;" and to all other points covered by the opinion above mentioned, are correct.

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VII. WHAT ALL PARTIES CONCERNED

" *SHOULD DO ABOUT IT.* "

1st. As to the Provincial Government and the City of Quebec.

It has been demonstrated ; that when the original contract and specifications for the construction and equipment of the Railway were entered into, the Government and the City were represented in the Board of Directors of the said Company by four members each. That the Board so composed, subsequently approved of the line and grades of said Railway. That the question as to the sufficiency of the specifications to meet the condition that the Railway should be *first-class*, came before the Board in July 1873, when, in compliance with a Resolution of the Board, the Chief Engineer submitted to the President of the Company, a pamphlet containing the "Opinions of several Engineers respecting the Specifications." That subsequently, the Provincial Parliament passed the "Quebec Railway Aid Act," in which it was provided among other things, that the Government Directors in the Board should be increased to six. That subsequent to the passing of this act, a supplemental contract was entered into with the present Contractor, which supplemental contract was based entirely upon the original contract and specifications ; and was entered into by the Board so composed, after the question as to the sufficiency of the specifications had been duly brought under the notice of the Board, both at the time of, and subsequent to the execution of the original contract. That since said contracts have been entered into, the manner in which advances were to be made by the Provincial Government and the City of Quebec, in aid of the Company, has been changed as hereinbefore recited, with a view of facilitating a speedy construction of the Railway, under the existing contract and specifications.

That the Government and the City have each paid a large amount upon the estimates of the Chief Engineer of the Railway Company, which estimates were based entirely upon said original and supplemental contracts.

That the Provincial Government and the City Council have failed or neglected to appoint any Engineers, either to examine the line, grades, or plans of structures adopted by the Railway Company ; or to inspect the work executed in accordance therewith ; or to certify to the amount expended thereupon, until after the close of the past working season, when nearly a half million dollars had been in good faith expended upon the road ; although frequently and urgently requested, by the Chief Engineer and

other officers of the Railway Company, to make such appointments.

In view of the foregoing facts, it appears quite evident, that the Government and the City are each pledged by their previous acts and undertakings, to stand by the present contract in good faith; and to carry out all of its provisions in their integrity; and that the Government is precluded from raising any further questions as to the character and sufficiency of the work provided for by the existing contract and specifications, until such time as it is fully completed, and reported upon by the "Provincial Railway Board," as provided for in section 16 of the "Quebec Railway Aid Act of 1874."

When it is considered, that by the terms of the act of 1870, granting lands in aid of the Company, the Government has power to withhold these valuable timber lands, now amounting to 1,140,875 acres, until: "The said Railway shall have been completed and put in operation to the entire satisfaction of the Lieutenant-Governor in Council," it is difficult to see what better security the Government could hold, for the faithful performance of all obligations imposed upon, and assumed by the Railway Company.

And even had Government no such security, it is manifest from the reports, correspondence, &c., referred to herein and appended hereto, that the work being done, and for which the contract and specifications provide, are such as will meet the requirement that the road shall be first class.

The height of grades, a difficulty of easy solution, being perhaps the only one objected to by the Government Engineer, which is not fully and satisfactorily answered thereby.

2nd. As to the Railway Company.

In view of the facts and considerations heretofore referred to, as being of binding force and effect upon the Provincial Government, and the City of Quebec; and of the further fact, that all the foregoing considerations were duly brought to the notice of the Board of Directors at, and before the time of the execution of the existing original and supplemental contracts for the construction and equipment of the Railway; and have also had their due weight and influence in the subsequent expenditures upon the road, it would certainly appear that the Railway Company should, in good faith to all parties concerned, stand by and uphold the existing contract in its integrity; holding the contractor to a strict compliance with all its provisions, both as to the manner, and time in which the road shall be constructed; until it shall have been clearly demonstrated that the character of the work, and the materials therein provided for, are not such as are required

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by its act of incorporation, and the subsequent enactments under which it is to receive aid from the Provincial Government and the City of Quebec.

Although the recent Report of Mr. Sandford Fleming seems to have been generally regarded as a revelation or discovery, of equal, and perhaps greater importance and magnitude than the one previously made by the Government Engineer; yet I have been totally unable to discover, that further than to *fully sustain* the previously expressed views of the Chief Engineer, with reference to his powers, duties and responsibilities under the existing contract, he has succeeded in throwing any more *light* upon the subject, through the medium of his present report, than was reflected from his published letters of 1873, to which he now refers as fully expressive of his present opinions; and which, as before stated, has been *shining* steadily upon the Government, the City, the Railway Company, and every one connected therewith during all of their subsequent acts connected with the location and construction of the Railway.

By reason of this important fact, it was at my own suggestion, *distinctly understood*, that the Railway Company was not to be governed or bound by any further opinion which Mr. Fleming might think proper to express upon this particular subject.

It was also in consequence of this understanding, that I subsequently referred the matter again to Mr. Walter Shanly, who had also given an *adverse* opinion to that of Mr. Fleming upon the same subject, in 1873; which opinion had also been before the Board of Directors, the Government, and the City, during the same length of time.

And it is in consequence of this understanding, together with the further important facts, that Mr. Shanly has since been *solicited* to become the *Government Inspector* of the road; and also the *Advisory Engineer of the Railway Company*, each party, by this act, having fully endorsed his previous views, both as to the true intent and meaning of the original contract and specifications, and as to the character or *class of Railway* provided to be constructed under their provisions, that I now consider his more recently expressed opinions, already referred to, and hereto annexed, as being entitled to even more consideration; and as being of really greater binding force and effect upon the Railway Company and the Government, than those contained in Mr. Fleming's previous letters and present Report.

3rd. As to the Chief Engineer.

If, after the most thorough and searching investigation, the Railway Company shall become satisfied that the Chief Engineer is professionally incompetent to fill the position which he now occupies; or that he has failed in the due performance of his duties at all

times, and under all circumstances; or that he has ever acted in bad faith towards the Railway Company, or the Contractor, it will clearly be his duty to place his resignation in the hands of the Company, and to leave the Country in disgrace.

On the other hand, if he shall still retain the confidence of the Company, it will be as clearly his duty to continue to use his best endeavors to promote the interests of the Railway Company, the Government, the City of Quebec, and public at large, by the speedy and proper completion of the great enterprise with which he has had the honor of being so long connected.

In doing this, however, he should not fail to aid and encourage the Contractor, by every legitimate means at his command, to prosecute the work with vigor; and with a due regard to all the requirements of the contract.

4th. As to the Contractor

Having, as a Director of said Railway Company, previous to, at the time of, and subsequent to the execution of the original contract; and also at the date of his becoming the assignee of said contract; and as such Director, necessarily knowing that the only maps and profiles of the line for which the present Railway Company, or its Chief Engineer could be held responsible; or that could have been discussed during the negotiation of said original contract, were those of 1871, which show a much more expensive line to construct, than the profiles that have been adopted since the execution of said contract.

And having, as such Director become possessed of the "Opinion" of the present Chief Engineer respecting the true intent and meaning of said contract, as the same is fully expressed in the document hereinbefore referred to entitled "Opinions of several Engineers respecting the specifications," dated July 14, 1873.

And having become the assignee and legal representative of the original contract: "hereby declaring that he is well acquainted with the terms of said contract, and with the specifications thereunto annexed"; and having undertaken by the terms of said assignment: "that he will fulfil all the obligations undertaken by them (the original Contractors) in virtue of the said contract, towards the said Company, for which they may be now liable, or which may hereafter become due under the said contract, from and after the first day of the said month of January instant"; and having also undertaken and bound himself, in the existing supplemental contract, to do and perform certain works and obligations, in addition to, and which are not provided for in said original contract; and also having entered upon and executed a portion of said work and undertakings; and received payments therefor, with a full knowledge of all the conditions and requirements contained in said contract, and the laws therein referred

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to, in respect of the Railway being *first-class* in its construction and appurtenances, it would certainly appear to be his duty to meet his obligations promptly and in good faith; and in such a manner as to secure the completion of the great work which he has undertaken, in the manner, and within the time specified in the existing contract.

In doing this, however, he should not fail to recognize and consider the responsibilities which are imposed upon the Chief Engineer, by the terms of the contract.

5th. As to the Changes proposed.

In view of the objections which have been raised to the *width of our earth works*; I would respectfully submit, that from the best Engineering and legal opinions hereinbefore referred to, and which have been elicited previous to, and during the present discussion of this question, there can be no reasonable doubt that the existing contract provides for a *width of road-bed*, of "not less than *twelve feet*" at the top, or *full grade* line, when the road is properly ballasted, and ready to receive the cross-tie or superstructure of the track; and also, that a width of *at least fifteen feet*, and as much more as the Engineer may think necessary, is fully provided for at *sub-grade*, or the *base* of the ballast, when the native material is found to be unsuitable for the reception of the cross-tie.

Also, that the above lateral dimensions are fully up to the requirements of a *first class Railway*.

That the existing contract and specifications were prepared by the Chief Engineer with a view of producing the above result, is fully demonstrated in the former part of this report; in the pamphlet containing, "Opinions of several Engineers"; in "Appendix No. 1," in which is embodied his opinion, written and published in 1865, of the standard which should be, and was adopted for the Union Pacific Railway; in his "Gauge, Report," written and published in 1871; and also in his recent "Correspondence with Mr. Fleming," as contained in "Appendix No. 6."

That the same views have also been entertained and acted upon by the original and present contractors, is fully evidenced by the fact, that the work has heretofore been staked out by the Engineers, and executed by the contractors, with a view, when fully completed, of producing the same results.

I may also add, with reference to this question of *width of earth-works*, that it would be *quite as inconsistent* for me to make any material departure from my former practice, at this time; as it would be for Mr. Fleming and Mr. Light to depart from theirs,

while they, with a full *Government Treasury* to draw upon, are now standing where Mr. Shanly stood *a quarter of a century ago*, when, to use his own language :

"I fought for 18 and 20 feet at sub grade ; even though everything above that line had to be "robbed" to secure the coveted widths; and that too, very frequently, when money was so scarce that I did not know from month to month from what source the "next estimate" was to be paid."

In view of the objections which have been raised to the *height or elevation of our earth-works* above the natural surface of the ground ; but *more particularly* in view of the *unanswerable argument*, which Divine Providence has seen fit to promulgate during the past few weeks, in the way of the most extraordinary obstructions from snow that have ever been experienced, in this or any other country, I would respectfully advise, that the *top-rail-grade-line* be so arranged, as to secure an elevation of *at least three feet* above the natural surface of the ground, in all cases where this elevation is not *necessarily* controlled by *maximum grades, minimum curves, unavoidable cuttings, bridge elevations, and bridge approaches* ; also by a due regard to dangerous or objectionable *undulations* in the grade.

In consideration of the *very decided objections* which have been raised by the Government Engineer and the Contractor ; and also endorsed to some extent by Mr. Fleming, respecting the *weight and dimensions of our bridge masonry* : I would respectfully recommend, that the same be increased to any extent that shall be found necessary to meet the views of these gentlemen ; having at the same time, due regard to the natural flow and expansion of the streams ; and also to the 6th clause of the "General Provisions" of the "Specifications for the Main Line," which provides that "*nothing superfluous* will be required," &c.

In consideration of the *doubts*, which have been expressed by the Government Engineer and the Contractor ; and also endorsed to some extent by Mr. Fleming, respecting the safety and adaptability of the present plans and specifications for *composite foundations in deep-water* ; I would respectfully recommend, that the same be either *strengthened and improved*, to any extent that may be found necessary to meet the views of these gentlemen ; or that they be *discarded entirely*, and the "coffer dams" referred to in the "General Specifications," be substituted therefor ; having at the same time due regard to the "Superfluous" provision in the "General Specifications" above referred to.

The above recommendations respecting masonry and foundations, are made at this time, because I believe that it would be

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good policy on the part of the Company, under all the circumstances, to yield the points, in order to fully satisfy the demands of the Government, if further insisted upon; and not because I have any doubts whatever, as to the entire sufficiency of the plans heretofore adopted for these purposes.

6th. As to extra allowances to the Contractor.

In view of the fact that the Contractor claims that, without his consent, no changes can be made by the Engineer or the Railway Company, in the line, grades, plans, specifications and schedules, that have once been placed in his hands; I would respectfully submit, that all the Engineering, as well as legal authorities thus far consulted, are *clearly against* such a construction of the contract; except in cases where he may have entered upon the work, and made some expenditure in connection therewith which would be lost to him by reason of such change; in which case, as Mr. Fleming expresses it: "the contractor should be *indemnified* for loss so sustained."

Without having made any definite calculation, I will venture the opinion that, in case the changes hereinbefore suggested and recommended, are adopted by the Railway Company, and approved by the Provincial Government and the city of Quebec, the "indemnity" above referred to will amount to *less than twenty thousand dollars*.

With a view of settling this matter justly and amicably however, as well as the manner in which this indemnity is to be made to the Contractor, I would respectfully recommend that Mr. Fleming's decision, based upon the joint or separate reports of the Government Engineer, the City Engineer, the Contractor's Engineer, and the Chief Engineer, shall be considered as *final and binding upon all parties*.

34

VIII. CONCLUSION.

I have but to remark *in conclusion*, that if, in travelling over the long and tortuous path which the importance of the subject herein discussed has seemed to render it incumbent upon me to pursue, I have succeeded in investing the matter with sufficient interest to induce other parties to follow me, who in my opinion, have a much deeper interest in the result of the present unfortunate controversy than myself; and, what I can but regard as of much greater importance, to arrive at the same *general conclusions* which have forced themselves upon my own mind, as to the proper answer that all parties should give to the important question which has of late engrossed the undivided attention of so many minds, to wit: "*What should be done about it?*" I shall never cease to feel that I have now performed the greatest service that it has ever been my duty, as well as pleasure to render to the Company, which has never failed to honor me with its *entire confidence*.

All of which is most

Respectfully Submitted,

SILAS SEYMOUR,

Engineer in Chief.

To THE

PRESIDENT AND DIRECTORS.

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APPENDIX No. 1.

AMERICAN STANDARD FOR FIRST-CLASS RAILWAYS.

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APPENDIX No. 1.

AMERICAN STANDARD FOR FIRST-CLASS RAILWAYS.

UNION PACIFIC RAILWAY.

The charter of this Company, as granted by the Congress of the United States in 1862, requires that the Construction, Equipments, and all other appurtenances connected therewith, shall conform in their character to a "*First Class Railroad.*"

In order to secure this result, the President of the United States was authorized to appoint five Government Directors to sit at the Board, one of whom was to be placed upon each standing Committee. Also three Government Commissioners, whose duty it should be to report upon the character of the different sections of the Road as completed; and upon the certificate of these Commissioners; the Government subsidy, amounting in the aggregate to *Fifty Million Dollars* was paid to the respective organizations named in the charter.

In February 1866, the Secretary of the Interior, by order of the President, directed that the Government Directors, Commissioners and Engineer, should be convened at Washington, for the purpose of determining on a standard for the construction of the road that should meet the requirements of the charter.

Previous to the meeting of this Board, Lt. Col. J. H. Simpson, U. S. Engineers, who was Chairman of the Board, addressed letters to several of the prominent Engineers in the country, requesting their views upon the different points that would come before the Board.

The following extracts from the replies of some of these

Engineers, express the views entertained by them respecting the proper width of earthworks.

GENERAL HERMAN HAUPT of *Philadelphia*, says :

"The width of road-bed, even on the same line of road should not be considered a fixed and invariable dimension. The elements which determine the width of road-bed (for double track) are the gauge of the track, the distance between tracks, and the width of the side ditches." "In a shallow excavation in dry earth, I would give the side ditches a width of five feet at top, three feet at bottom, and slopes of forty-five degrees. And in this case, allowing the gauge of tracks to be 4 ft. 8½ inches, the distance between tracks 6 ft., the length of cross-ties 8 ft., and *two feet from ends of ties to edge of ditch*, the minimum would be 22 ft. 8½ inches; but 24 ft. is better."

MR. JOHN B. JERVIS, of *Chicago*, says :

"*Width of road-bed at grade, &c.*—In excavation, the road-bed should be considered the base of the ballast. If this is two feet below the rail, the width should be for road and slopes about 16 feet. The slopes will occupy 3 feet each side, and 10 feet for breadth of road and proper support for the ties."

MR. G. A. NICHOLS, *Genl. Supt. Phil. and Reading Railroad*, says :

"On a double track railroad, the two main tracks should not be less than 6 feet apart, and sufficient room should be allowed in cuts for good and thorough drainage on each side. On embankments the edge of the bank should not be less than two feet outside end of sills. Ballast should not be less than 10 inches thick, making about 1760 cubic yds per mile of single track."

HON. JESSE L. WILLIAMS, of *Fort Wayne Ind. Civil Engineer and also a Government Director of the Road*, says :

"*As to width of embankments and excavations.*—On all parts of the roads or its branches, where a single track is contemplated, embankments should not be less than 14 feet wide on top, this width being necessary to receive the ballast, whether put on before or after the track is laid."

MR. ASHBEL WELSH, *Civil Engineer of Lambertville New Jersey*, says :

"I make road-bed at grade 14 feet wide for single track, with side ditches in excavation 8 feet wide at grade, and 2 feet deep; the size of the ditches, however, varying with the circumstances. Ballast should be at least one foot deep under the tie."

MR. SILAS SEYMOUR, of *New York, the Consulting Engineer of the Road*, was also requested to furnish the Board with an opinion upon the various points submitted.

As his letter, which was read before the Government Board, contains the views which he then entertained upon this, as well as many other subjects, which it may be found expedient to refer to, the correspondence is given entire, as follows :

Lt. Col. Simpson to Mr. Seymour.

Department of the Interior,

ENGINEER OFFICE,

Washington, D. C., Dec. 18th 1865.

It being desirable to establish a standard to which the Pacific and other railroads in which the Government has an interest shall be made to conform, I am instructed by the Hon. James Harlan, Secretary of the Interior, to solicit your opinions on any of the following points which your experience and observations will enable you to give :

- 1st. Weight of rail for a first class road, relative durability of rails of different weights with same traffic, best cross section for same, and merits of different varieties of American iron.
- 2nd. Best plan for chairs, spikes, or other joint fastenings.
- 3rd. Dimensions of and distances between ties.
- 4th. Width of road bed at grade, in excavation and embankment, dimensions of side ditches in the former, depth of ballast, and expense per mile it would be worth incurring to get it.
- 5th. Relative advantages of different plans and materials for railroad bridges.
- 6th. Weight and other characteristics of engines and rolling stock suitable for a large business and different grades.
- 7th. Ratio in which rails and rolling stock deteriorate with different velocities.

In the above, interest on first cost is to be considered in connection with expense of repairs and deterioration, so that their annual sum shall be a minimum.

Your views on these points, as well as on any others, having an important bearing on the subject, are desirable, in order that they may be laid before a meeting of the Government Commissioners, Directors, and Engineer of the Pacific Railroad, early in January next, and should, if possible, be sent to this office before the 1st January. They will be every valuable in aiding the Government in establishing such a standard for these roads that,

when finished, they will sub-serve the purposes for which they are built, and be a credit to the nation.

Please address me under cover to the Secretary of the Interior.

I am, very respectfully,

Your obedient servant,

J. H. SIMPSON,
Lieut. Col. Engineers.

To Col. S. Seymour, C. E., and
Consulting Eng., U. P. R. R.

Mr. Seymour to Lt. Col. Simpson.

Union Pacific Railroad Company,

ENGINEER DEPARTMENT,

13, William Street, New-York, January, 29th 1866.

COLONEL: I have the honor to acknowledge the receipt (some weeks since at Omaha) of your circular letter of the 18th of December, 1865, accompanied by a circular from the honorable Secretary of the Interior, in which you invite my opinion on several points connected with the construction and operation of railroads, with a view of laying it, with others of the same character, before a board of "Government Commissioners, Directors, and Engineer of Pacific railroad," for the purpose of "aiding the Government in establishing such a standard for these roads," (the Union Pacific and its branches) that, when finished, they will sub-serve the purposes for which they are built, and be a credit to the nation."

A reply to your communication would have been forwarded at an earlier day, had you not informed me, in person, that the meeting of the board had been postponed from early in January to early in February.

The position which I have the honor to occupy, of consulting engineer, of by far the most important of the roads referred to in your letter, might be regarded as placing me in a position of some embarrassment, and possibly of warping my judgment in relation to the subject matter of your letter; but I shall endeavor, in what I may say, to be entirely frank, as well as independent of any interests which I may be supposed to represent. I shall claim your pardon, however, if from this, or any other consideration, my discussion of the subject takes a somewhat wider range than appears to be contemplated in your letter.

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The law of congress, granting government aid to the Union Pacific railroad and branches, provides that they shall be built as "*first class railroads*." It also provides, that the President of the United States shall appoint three commissioners, whose duty it shall be to examine the roads and certify to this fact. It also provides that the President shall appoint five government directors for the Union Pacific Railroad Company, one of whom shall be placed upon each of the standing committees of the board. It also provides that the President shall fix the eastern terminal point, the point of crossing the 100th meridian of longitude, and approve the location between these points. It also fixes the extreme limit to the grades and curves of the road, the width of gauge, and character of the iron rails.

With all these safe-guards thrown about these roads, for the purpose of protecting the interests of the government and securing their proper construction, it would seem almost impossible (unless the government officers fail in the performance of their duty) for the railroad companies to evade a proper discharge of the responsibilities imposed upon them by Congress; and it will, in my opinion, be equally difficult for the board of government commissioners, directors, and engineer, referred to in your letter, to establish a common and unvarying standard for the construction and equipment of these roads. The term "*first class*" railroads, as generally used in this country, does not, as far as my experience and observation extend, either depend upon, or apply to any particular "weight or cross-section of rail, plan of chair, spike or other joint fastenings, dimensions of and distance between ties, width of road-bed at grade in excavations and embankments, dimensions of side ditches, depth of ballast, different plans and materials for railroad bridges, weight and other characteristics of engines and rolling stock, or ratio in which rails and rolling stock deteriorate with different velocities."

You will find that all the foregoing characteristics which are specified in your letter, not only vary materially on the different first-class roads throughout the country, but upon the *same road*.

I do not know of a first-class railroad of any considerable length that has not almost every variety of weight and pattern of rails, chairs, engines, cars, plan of bridges, width of road-bed and ditches, machine shops, station houses, etc., etc. These are or have been generally governed either by the location of the road, the grades and curvature, the peculiar views of Engineers, the financial condition of the Company, or the nature and extent of the traffic for which the road was constructed. You may, therefore, select any number of the acknowledged first-class roads throughout the country, and you will find that their general characteristics will vary just in proportion as their peculiar location, the views of their builders, and the character of their business varies.

You will also find that these roads have generally, if not in all

cases, been constantly improving their condition in regard to structures, outfit, and other particulars, since their first construction, in order to keep pace with their constantly increasing traffic, so that a road five or ten years old presents an entirely different aspect from what it did when first opened to the public as a first-class railroad. Hence it may be considered perfectly safe to assume that all these things will be regulated by the managers of the road as fast as the interests of the company or the requirements of the public may demand.

In view of the foregoing facts and considerations, I have assumed that the term *first-class railroad*, as intended by Congress, to be applied to the Union Pacific Railroad and its branches, means a railroad suitable and proper in all respects for the nature and extent of the traffic which the whole or any portion of the road may reasonably be expected to do when first opened to the public, of which the commissioners appointed by the President were to be the judges; and that everything beyond this was intended to be left to the future control of the stock-holders and managers of the road, whose interests will at all times be at least twice and perhaps, three times as large, as those represented by Government; and further, that in granting a liberal donation of lands and loans of Government securities, to aid in the construction of these roads, the character of the roads and their outfit was a secondary consideration with Congress, when compared with the great importance to the Government and country of their speedy construction.

I have therefore advised that the line should be so located as to admit of the present or future adoption of the easiest gradients and curvatures consistent with reasonable length of line, and cost of construction; that the excavations, embankments side ditches and cross drainage, should be of liberal dimensions; that the culverts and bridge abutments should be permanently built of stone whenever it was to be found within reasonable distance; and when it was not, to use the most durable timber attainable, with a view to the substitution of stone hereafter; that the truss bridges of long spans should be of the best plans in use, and composed of durable timber; that the cross-ties should be of liberal dimensions, of the most durable timber attainable, and laid not less than twenty-four hundred to the mile; that the iron rails should be of the most approved quality and pattern, weighing not less than fifty pounds per lineal yard, and thoroughly secured to ties with wrought iron chairs and spikes; that the track should be ballasted with the best material on hand; that sidings not less than two thousand feet in length should be inserted, and water stations constructed at intervals of ten, twenty, or thirty-miles, as the probable running arrangements of the road would require: that permanent and capacious machine shops and engine houses should be constructed at the Eastern terminus, and at proper locations

along the line to afford the necessary facilities for repairs, at intervals of from two to three hundred miles; that passenger and freight stations should be constructed of suitable dimensions and at proper points, to accommodate the probable business of the road when opened to the public; that the road should be fenced and cattle-guards put in wherever it passed through cultivated farms or districts; that the rolling stock should be of uniform pattern, of the best quality and workmanship attainable, and sufficient in kind and quantity to accommodate the traffic; and that beyond this, no money should be expended at present, except in pushing the work forward with the greatest possible energy and despatch.

I have never for a moment doubted that a road of the character above described would come clearly within the requirements of the law, entitle the company to the Government aid which Congress intended should be placed at their disposal, "subserve the purposes for which it was built, and be a credit to the nation."

Having thus stated the general principles which, in my opinion, should govern the action of your board, I will now proceed to state, as consisely as possible, my views on the specific points submitted in your letter.

1. I consider that a rail of good quality of iron, weighing fifty pounds per lineal yard, of the Union Pacific railroad pattern, when properly supported, is the best and most durable rail that can be used for ordinary traffic on level or moderate grades. The weight of rail, or underlying support, should be increased proportionately as the weight or draught of the engine is increased, by reason of steeper grades or other causes.

2. The best joint fastening now in use I believe to be the *fish-joint*: next to that is the wrought-iron chair of the pattern adopted by the Union Pacific-Railroad Company.

3. Cross-ties should be eight feet long, and six by (not less than) eight inches square, and should be laid not less than twenty-four hundred to the mile.

I desire to say in this place that I am not now, and never have been, in favor of a cross-tie track. I believe that a continuous bearing of timber (say eight by twelve inches) is much the safest, as well as cheapest in the end. I have scarcely taken up a newspaper within the past month, that has not recorded a serious accident and loss of life occasioned by a broken rail. These accidents could not occur with a continuous bearing of longitudinal timber underneath the rail; if the rail should break, it could not get out of place. Broken axles and wheels, as well as most other accidents to the running machinery, occur from the same cause, or from the shock occasioned by passing from a full bearing on a cross-tie, over the vacant space between the ties. The rail in time becomes desintegrated and weakened, and finally breaks. I would rather have a forty pound rail, laid on a continuous

bearing of timber, than a fifty pound rail laid on a cross-ties two feet a part from centre to centre. The saving in the wear and tear of rolling stock and rails, will be at least ten per cent. per annum.

4. The width of road-bed proper at grade, or bottom of tie, both in excavation and embankments, composed of material that does not wash or slide, should not be less, and need not be more, than twelve feet. The dimensions of side ditches should be governed by the probable amount of drainage and the width between bottom slopes of excavations; and by the character of material and depth of cut.

5. I consider the "McCallum patent inflexible arched truss railroad bridge" to be the best in use. The "Howe truss" is the next best; either are good enough for any ordinary purpose. I have never been in favor of iron bridges for railroads.

6. A locomotive with five feet drivers, cylinders sixteen by twenty-four inches, and weighing from twenty eight to thirty tons, is the best for ordinary work on ordinary grades. If you wish to transport extraordinary loads on high grades, you must increase the power and weight or adhesion proportionally.

7. I think that, as a general rule, and with ordinary use, the rails and rolling stock of a railroad depreciate about fifteen per cent. per annum; and, with reference to different velocities, that they deteriorate in the ratio of the increase of speed; that is, the wear and tear is twice as great at a speed of twenty miles per hour than at ten, and so on to any reasonable limit.

The foregoing, I believe, covers substantially all the points specified in your letter. The views upon them are expressed hastily, and without resort to calculations or statistics.

In conclusion, I desire to express my entire confidence in the disinterestedness of the motives of yourself and the other officers who are associated with you on the part of the government, in connexion with this great national enterprise, in whatever you may do to elevate and establish the standard of the work. In doing this within reasonable and proper limits, you will always have my hearty co-operation and support.

I desire also to express the hope that you will not lose sight of the other great idea, that all these things are, or should be, subordinate to the vigorous prosecution and speedy completion of the road. Whatever you may do to facilitate this result will be regarded as a great public benefit.

I am Colonel, very respectfully,

Your obedient servant,

S. SEYMOUR.

Colonel J. H. SIMPSON,
U. S. Engineer, Washington, D. C.

The Government Board finally adopted the following standard for

EMBANKMENTS AND EXCAVATIONS.

"In all parts of the main line of road or branches, embankments should not be less than fourteen feet wide at the grade line. Excavations, if the cuts are lengthy, should be twenty-six feet wide, and in shorter cuts at least twenty-four feet; thus leaving in all cases room for continuous side ditches of ample depth and width, so as to secure that most essential requisite, a well drained Road-bed."

The width of *fourteen feet*, above referred to, was understood to be the width of embankment required at the *base of the ballast*, as expressed in Mr. William's letter; and the road was so constructed.

In regard to the character of the masonry required upon the Union Pacific Railway, the different Engineers consulted, generally express no opinions as to details, but unite in recommending *stone structures* instead of *wood*, wherever good stone can be obtained at a reasonable cost.

The following is quoted, however, as expressing the views of a gentleman, who is now regarded as the best authority in the United States, upon the subject of Masonry, he having prepared the plans and specifications for the "Washington Aqueduct;" and also of the "Capital Extension," at Washington, D. C.

GENERAL M. C. MEIGS, *U. S. Engineers of Washington*, D. C., says:

"The experience of the French Engineers has shown that it is not necessary, in order to build stone arched bridges of considerable span, to use expensive cut stone masonry.

There are arches of 90 feet span, and even longer, built of brick and *rubble masonry*, which stand secure. There is no difficulty with a sound, strong stone, breaking into reasonably good shapes, in constructing a stone bridge with arches of 120 feet span, entirely of *rubble masonry* laid in a strong cement mortar."

Inasmuch as the entire report of the Government Board, may be regarded as expressive of the highest authority in the United States, as to what should constitute a "*first class Railway*" it is given entire as follows:

WASHINGTON, FEBRUARY 5, 1866.

"The fourth and last meeting of the Board was held at 11 A. M. After it had been called to order the minutes of the previous meeting were read.

General Curtis, as Chairman of the business committee, read its report as amended at the previous meeting.

Mr. Williams suggested that the paragraph relating to sawed ties be amended to read, "If sawed, they should not be less than

eight inches wide, and not less than 2,400 per mile, or such number as will have the same bearing surface, provided that if any sawed ties have been already delivered or contracted for, only seven inches wide, they may be laid down."

On motion of Mr. White, the amendment was adopted unanimously.

At the suggestion of Mr. Harbaugh, and on motion of Mr. Williams, the following addition was made to the report: "Wherever cattle-guards and road-crossings are necessary they should be made."

On motion of Mr. Sherman, the report of Business Committee, as finally amended, was then adopted unanimously by the Board.

REPORT OF BUSINESS COMMITTEE.

Your Committee, to whom were referred various communications of experienced and scientific Engineers concerning a suitable standard for the work on the Pacific Railroad and its several branches, and to whom was also assigned the duty of presenting to the Board proper subjects for its consideration, as contemplated by the call of the Honorable the Secretary of the Interior, have the honor to present the following report:

The various locations through which the Pacific Railroad and its branches are destined to run, occupy such a variety of country as to render a specific style of work suited to all localities extremely difficult. The topographical features of the surface, the great variety of soils and lower strata of the earth, the singular variety of climate as to cold, heat, and wet and dry, all have to be considered in determining details of location, material, and form of the work. It was, probably, because of these difficulties, the laws of congress authorizing the construction, give only general or very meagre specifications as to the details of the Pacific railroad.

But your committee, after availing themselves of the views expressed by the several Engineers to which they have referred, and in contemplation of the reasonable construction of the law of congress, recommend to the board the adopting of the following general rules as those which should govern all parties engaged in directing, constructing, or accepting the work:

Every step taken in the work, and especially in the location of lines and grades, should be adapted to ultimate perfection, whatever may be immediate interests or necessities, so as to secure to the nation a grand and complete structure, every way worthy of our country, and honorable to the distinguished men who involve their capital and energies in so vast an enterprise.

LOCATION.

"Great care should be observed in the determination of the general and detailed location of the main-line and branches, so as

to secure the shortest lines consistent with economical grades to the most desirable passes of the mountain ranges. The law names but few points; still it is clearly the interest of the Government and not prejudicial to the companies, to determine such points as a great general line should have so as to unite, as far as possible, all the great ultimate purposes of a central and convenient channel for the commerce of nations that is likely to traverse the road.

With this general view of the work, careful and extended surveys should be made and well considered."

GRADES AND CURVES.

"While the law makes the grades and curves adopted on the Baltimore and Ohio railroad a standard, this is only to be considered as a limit to be adopted in mountain districts. To introduce grades of 116 feet per mile, or curves as sharp as 400 feet radius, on other parts of the road, would manifestly violate the spirit and intent of the law. Grades and curves should be settled upon principles of true economy and adaptation, based upon careful scientific and practical investigations, having due regard both to cost of construction and future working of the road.

It is safe to say, in advance, that on the Platte and Kansas Valleys, and on similar smooth valleys or level plains, no grade should exceed thirty feet elevation per mile."

EMBANKMENTS AND EXCAVATIONS.

"In all parts of the main line of road or branches, embankment should not be less than fourteen feet wide at the grade line. Excavations, if the cuts are lengthy, should be twenty-six feet wide, and in shorter cuts at least twenty-four feet; thus leaving in all cases room for continuous side ditches of ample depth and width, so as to secure that most essential requisite, a well drained road-bed. Rock excavations should be not less than sixteen feet wide, and all tunnels should be excavated for a double track. Slopes of earth embankments should be one and a half base to one rise. Excavations, except in rock, should have slopes from one to one and a half base to one rise, depending upon the material; or if steeper, then to have increased width at grade, so as to remove the same quantity of earth contained within the slopes."

MECHANICAL STRUCTURES.

"Culverts and abutments for bridges and drains should be of stone, whenever a durable article can be obtained within a reasonable distance, say from five to eight miles, depending upon circumstances; provided that temporary trestles may be adopted upon assurances, to the satisfaction of the Commissioners, that

stone abutments will be substituted immediately after the line shall be opened, so that stone can be transported thereon. But if good stone be too remote, then hardburned brick or wooden trestle work may be adopted. The wood to be of the most durable character the country will afford; and the wood or brick to be replaced by stone when that material can be conveyed conveniently by rail. Bridges of stone, or iron or wood, (such as Howe truss, or other equally good structure) should be used at the discretion of the company."

BALLASTING.

"A railroad cannot be considered complete until it is well ballasted. If composed of gravel or broken stone it should be from 12 to 24 inches thick, depending on the lower material. In view of the settling of new embankments, which require time and rains before ballasting can be properly placed, and also in view of the number of miles required by the law to be constructed annually, the perfect finish of the road-bed in this respect must be progressive and the work of time. Yet it is the opinion of the board that such work of perfecting the ballast must proceed as usual on first-class railroads; otherwise subsequent sections should not be accepted, because the whole work is not then being carried forward as a Great Pacific Railroad, such as the law contemplates."

CROSS-TIES.

"Oak or other suitable timber should be used, where it can be obtained with reasonable transportation. When such timber cannot be had for all the ties at reasonable cost, then the best the country affords may be adopted; but if it be cottonwood, or similar soft material, it must be Burnettized or Kyanized thoroughly so as to increase its durability. But in all cases the joint tie should be of oak, or other suitable timber, the better to hold the spikes at these points. There should be at least 2,400 ties to the mile. They should be eight feet long, six inches thick, and, if hewn, six inches on the face. If sawed, they should not be less than eight inches wide and not less than 2,400 per mile, or such number as will have the same bearing surface, provided that if any sawed ties have been already delivered or contracted for only seven inches wide, they may be laid down."

RAILS.

"These are to be of American iron, as required by law, of the best quality, and should weigh sixty pounds to the yard. But in consideration of the great cost of transportation from the present

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location of rolling mills to the remote sections of this road, iron may be adopted which weighs only fifty-six pounds to the yard.

In mountain districts, however, where heavier engines will be used, not less than sixty-pound rails should be adopted; provided that if any of the companies have on hand or *in transitu*, or contracted for, any rails of different weight from that herein specified, and not under fifty pounds per yard, such rails may be used. The rails should be attached to each tie by spikes driven on both sides of the rail. As the nearest approximation to a continuous rail, the so-called fish-joint is preferred and recommended; but if found that it will retard the progress of the work, the common American wrought iron, chair may be used."

SIDINGS.

"The length of side tracks should be at least six percent. of the line completed, to be increased as the number of passing trains shall demand. Side tracks should also be laid eight feet apart in the clear between the rails. Wherever cattle guards and road-crossings are necessary they should be made."

ROLLING STOCK.

"Locomotive engines and cars must be provided in liberal proportion to the traffic and the convenient construction, to be increased from time to time as the completion of additional sections and the increase of business seem to require."

BUILDINGS.

"Engine-houses, repair shops, and station buildings should be adapted to the wants of the service.

At the opening of business, the extent and capacity of buildings may be only such as to provide liberally for the existing rolling stock and the business of the road, and such probable early increase as may seem likely; yet the plans in all cases, both as to the buildings and grounds, should be arranged for prospective enlargements and extensions equal to any future business of the road, the buildings at first erected forming appropriate parts of a complete and systematic whole.

Engine houses and repair shops at the principal stations must in all cases be of stone or brick, with good stone foundations. The covering should be slate or metallic, to guard as far as possible against fire.

Water stations should be erected at convenient distances to suit the wants of the trains.

Extensive and convenient locations of ground should be procured to accommodate a future large business, and the proper

titles should be carefully secured. All this is the more desirable, as lands are now easily obtained at moderate prices.

In these specifications it is believed that nothing is required which may not be regarded as essential to a commodious and complete railroad. Nothing is proposed to retard the progress of the companies. The importance and public desire for accelerated movement have been fully appreciated, and the board earnestly desires to favor and foster the energy and fidelity which now seems to animate those engaged in the construction. But while guarding against delay on one hand, the public interests require, on the other, a substantial and complete work, and the highest perfection of track reasonably attainable on a new road is expected and projected as the standard to which the workmen are to arrive. The argument in favor of speedy construction must be subordinate to the substantial objects of the road, and the government must be certain to have a work that will convey her mails, troops, and munitions of war, and commerce of the country with entire certainty, celerity, and convenience. It is the aim of this board to secure all these objects, and it is also our belief that they are not incompatible it being only necessary on the part of the government to insist upon the reasonable requirements embodied in this report to hasten the completion of the great work, and at the same time adapt it to the high public interest which it is intended to subserve."

The question having been raised as to whether the "General Specifications" for the main line of the North Shore Railway, are sufficient to secure the construction of a *First Class Railway*, according to the general acceptance of that term; more particularly in regard to the *width of earth works*, and the *character of masonry*, the following extracts from the specifications under which the "New-York and Erie," and the "Chicago and North Western Railways" were constructed, both of which are regarded in the United States as *First Class Railways*; and also a quotation from the specifications for the "Montreal Northern Colonization Railway," are given for the purpose of comparison with the specification for the same work upon the "North Shore Railway."

NEW-YORK AND ERIE RAILWAY (6 feet gauge).

Extracts from the Specifications.

"The work shall be executed under the direction and constant supervision of the Engineer of the Company, by whose measurements and calculations, the quantities and amounts of the several kinds of work performed under this contract shall be determined, and whose determination shall be conclusive upon the

parties, and who shall have full power to reject or condemn all work or materials which in his opinion do not fully conform to the spirit of this agreement, and shall decide every question which can or may arise between the parties relative to the execution thereof, and his decision shall be final, and binding upon both parties.

GRADING.

"Where the road is graded for a single track, it will generally be fourteen feet wide at grade on embankments, twenty feet in thorough cuts, and seventeen feet in side-cuts. The side-ditches which are included in the above widths, will be four feet wide at grade. The double track will usually be twenty-six feet wide on embankments, thirty-two feet in thorough cuts, and twenty-nine feet in side-cuts. The slopes of earth excavation will usually be one and a half to one, but will vary from this according to circumstance, at the discretion of the Engineer. In rock cuttings they will vary according to circumstances, being generally four inches horizontal to one foot vertical. When the excavations are in clay, or other material unsuitable for the road-bed, the contractor shall, when required by the Engineer, excavate to such a depth below grade as the Engineer shall direct, and shall fill the space so made with good clean gravel or other suitable material. Clay embankments are in like manner to be covered with one foot of good gravel. Rock excavations are to be made one foot six inches below grade, and the space re-filled with gravel.

The materials composing the embankment must be approved of by the Engineer, and in places where the natural surface of the ground upon which the embankment is to rest is covered with vegetable matter, which would in the opinion of the Engineer impair the work, the same shall be removed to his entire satisfaction.

Besides the ditches named above, ditches shall be made when required by the Engineer, leading to and from the works of drainage of the road; also excavations for turning, or making of watercourses and roads, all of which shall be done according to the direction of the Engineer.

All materials found in the road-bed, side ditches, or borrowing pits, must be moved in such manner, and deposited in such places as the Engineer may direct. In cases where the excavations of ordinary width are insufficient to form the contiguous embankments, the deficiency shall be supplied by widening the cuts, or from the sides of the road, or from borrowing pits.

All borrowing pits shall, if required by the Engineer, be dressed to a good shape, and properly drained.

MASONRY.

"The different varieties of stone-work, comprising slope and retaining walls, square or box culverts, arch culverts, and bridge abutments and piers, must be executed in a skillful and workmanlike manner, after the general plan of alternate headers and stretchers, and must be composed of durable and well shaped stones, adapted to the formation of the different structures.

The end walls of box culverts must be neatly hammer-dressed, and laid in courses not less than six inches in thickness. The coping on the parapets to be handsomely dressed, and brought to a close vertical joint, to extend at least eighteen inches from the face.

The arch culverts are to be well laid throughout in mortar, formed of hydraulic lime, unless otherwise directed. The dimensions of the arch stone to be such as to extend through the entire thickness of the arch, to be placed perpendicular to the curve of the same, and to be well and closely fitted. The outer, or ring stone of the arch, to be as nearly uniform in thickness as possible, and to be neatly dressed with a bush-hammer and chisel, and to be well bonded with the contiguous arch stone, breaking joints at least eight inches. The side, end, and wing walls, are to be formed of well shaped stones of the proper thickness, the beds to be pointed down, so as to give an even bearing; to be hammer-dressed on their exterior faces, and the wings and parapets to be surmounted with a coping of broad, flat stone, of at least six inches in thickness, neatly dressed, and brought to a close vertical joint. The coping and ring-stone, as also the arch and cap stone, to be included in the estimate, with the other masonry, without extra charge.

The bridge abutments and piers, to be formed of sound, durable, and well-shaped stones, of the proper thickness. The end joints to be dressed back close, for a distance of at least eight inches from the face of the wall. The beds must be pointed down, so as to give a firm and even bearing over the whole surface of the stone, and must be brought to half inch joints, both vertically and horizontally. The face of the work to be rock-dressed with cut quoins. The whole to be well laid in full mortar, composed of hydraulic cement, the general proportions of which will be one part of lime, to two of sand, which must be thoroughly mixed upon a platform of boards, and applied to the work within the proper time for rendering the adhesion and solidification most perfect.

Retaining Walls will vary in dimensions, according to circumstances; ordinarily, they will be two feet six inches thick on top, and have a slope or batter on the face, of one-tenth horizontal, to one foot vertical. The walls will be sunk to such a depth as is necessary to secure a solid and permanent foundation. The stone

used in the walls must be of a firm and durable character, well-shaped, and of sufficient size to ensure stability. These walls must be so constructed, as to form a complete bond throughout their entire thickness, and neatly coped with flat stones two feet wide, and as long and heavy as the quarries will furnish.

Slope Walls will vary in thickness from one to three feet, and in slope from one to one, to one and a half to one, as the Engineer may direct.

Where these walls are founded in water, Rip-Rap foundations will be made of large stone and brush laid in alternates courses, so as to form a bond. By the term Rip-Rap, is meant, piles of rough stone, not dressed nor placed in a regular wall, but handled and disposed of by laborers, to suit the purposes intended; such for instance, as protection to banks, blind drains, foundations to masonry, &c.

The details of the character, proportions, and dimensions of the work, will be represented upon the plans; and all necessary information in relation to the preparation of foundations, manner and time of doing the work, &c., will be communicated by the Engineer as circumstances may require."

CHICAGO AND NORTH WESTERN RAILWAY (4 feet 8½ in gauge).

Extracts from the Specifications.

"That said work shall, in all particulars, be made to conform to the plans, specifications and directions of the Chief Engineer, and the Engineer in charge of the work, by whose measurements and calculations the quantities and amounts of the several kinds of work performed under this contract shall be determined, and who shall have full power to reject and condemn all work or materials which, in his opinion, do not conform to the spirit of this agreement, and shall decide every question which may or can arise between the parties, relative to the execution thereof, and his decision shall be conclusive and binding upon both parties hereto."

GRADUATION.

"The width of the road-bed at the grade line will be from twelve to fifteen feet on embankments, and from eighteen to twenty feet in excavation, including ditches, but may be varied, as may the width and depth of the ditches, according to circumstances, and at the discretion of the Engineer.

The side slopes of excavations and embankments will be of such inclination as the Engineer may designate.

All materials taken from excavations, except when otherwise directed by the Engineer, shall be deposited in the embankments.

The cost of moving the same, when the distance does not exceed feet, will be considered as included in the price per yard for excavation; also all materials necessarily procured from outside the road-bed, and deposited in embankments, will be paid for as excavation only; and for all excavations, whether procured from the road-bed or from outside the roadway, a price will be allowed per cubic yard for hauling each additional one hundred feet after the first feet hauled.

In procuring materials from outside the road-bed, the place and manner of taking it out shall be designated by the Engineer, and in excavating it care must be taken not unnecessarily to injure or disfigure the land.

Embankments will be formed in layers of such depth, and the materials distributed in such manner as the Engineer may direct; and all the material necessarily wasted from the cuttings will be deposited on the sides of the embankments, or in such other manner as may be directed by the Engineer; and, when directed by the Engineer, the contractors will deposit on the side of the railroad, or at such convenient points as may be designated, any rock or stone they may have excavated, and all such rock or stone so deposited, together with the timber removed from the width of roadway, unless allowed to be used in the work by the contractors, shall be considered the property of the Company.

The alignment and adjustment of the grades of the road may be changed whenever the Engineer may consider it necessary or expedient, it being understood that no claim will be made or allowed for damage, or increase of prices in consequence of such change.

The line will be divided into sections averaging about one mile in length, these divisions being made to accommodate, as nearly as practicable, the economical distribution of material found in excavations or required in embankments. But this will not prevent the removal of materials required for the road-bed, or mechanical structures, from one section to another, whenever, in the opinion of the Engineer, it may be necessary or expedient to do so."

MASONRY.

"The different varieties of stone work and masonry, comprising paving for foundations, rip rap, slope, retaining, battered and vertical walls, cattle guards, box and open culverts, arch culverts, bridge abutments and piers, &c., must be composed of durable and well-shaped stones, of the size and dimensions best adapted to the formation of the different works or structures, and the work must be executed in a substantial and workman-like manner, after the

general plan of alternate headers and stretchers, and all stones must be laid on their broadest quarry beds.

Paving, when made of flat stones, must be set upon their edges, and, whether flat or rubble stones are used, they will be set in such manner as to leave the least possible space between the stones, which must be of sufficient size to reach through the entire depth of the paving.

Rip Rap.—By this term is meant layers of rough stones placed on the slopes of embankments, or about the foundations of abutments and piers, culverts, trestle and piled work, &c., to protect them from damage by water, and also for blind drains, whenever required to be done.

Slope, Retaining, Battered and Vertical Walls will vary in thickness and slope, or batter, at the discretion of the Engineer, and when the walls are more than the thickness of one stone, whether laid dry or in mortar, they must be laid in such manner as to form a good bond throughout the entire wall.

Box, Open Culverts and Cattle Guards will be built of such dimensions and upon such plans as the Engineer may direct, and must be of good-sized and well-shaped stones, properly laid and bonded together by stones occasionally extending through the walls, the upper course bonding the entire wall. The covering stone of box culverts must be entirely sound, and long enough to extend at least two-thirds across each wall, and generally of a thickness equal to one-half of the width or space to be covered. The end walls of box culverts must be laid with extra care and finish, the stone being of good beds and builds, with joints and angles clean and square, so as to be free from spalls. The coping must be of proper and uniform thickness, and, if required, hammer dressed on the face, and so laid as to leave a slight projection over the front wall, and to extend back so as to give a good finishing bond to the work. The ends of the side walls of open culverts, cattle guards, &c., will be composed of square, well-shaped stones, laid in regular steps or offsets, to correspond with the slope of the adjoining bank, and so well bedded and fitted as to require no spalls or wedges to keep them permanently in place."

"*Arch Culverts* must be laid in the best hydraulic mortar, and will be built upon such foundations and plans, and of such dimensions, as may be directed by the engineer. The face stone of the abutments, or side walls, must be hammer-dressed to good beds and joints, and pitched in or scabbled to a line upon the beds and builds, corresponding with the finish line of the work. All angles that are exposed to view must be cut clean and sharp with the chisel, to an arras of at least one inch in width and laid to a perfect line. The work will be laid in courses, each of uniform thickness, with square, well-shaped stones of suitable size, brought to close joints and free from spalls, both vertically and horizontally."

"The face stones will consist of headers and stretchers laid alter-

nately so as to break joints. All headers shall extend through at least two-thirds the thickness of the wall, and shall have not less than two feet length of face. The width of any stretcher, measured on its bearing surface, shall always be greater than its thickness, and its length shall be at least three times its thickness; and there shall be not less than one header in every six feet of face."

"The backing stone must be of large size, with parallel beds, and laid so as to break joints with each other, and with the stones in the face of the wall, in such manner as to form a good bond throughout the entire wall."

"The stones composing the arch must be placed perpendicular to the curve, and extend entirely through the thickness of the arch, and be dressed throughout to close beds and joints. These must be laid in regular courses of uniform thickness, and the inner faces dressed smoothly to a line with the hammer."

"The outer or ring stone must be of the proper size and dimensions to correspond with the thickness of the arch, and must be neatly cut or dressed, and set to the line of the work."

"*Bridge Abutments and Piers* must be built of sound, good shaped stones, of the proper size and thickness for the dimensions of the work to be constructed. The face stone must be dressed to good beds and joints, so as to give a firm and even bearing over the whole surface of the stone, and pitched into a line upon their beds and builds corresponding with the finish line of the work. The manner of dressing and laying the stone, the proportion of headers and stretchers, and general style of finish, will be the same as above specified for "abutments or side walls of arch culverts." The upper course of stone on bridge abutments and piers must be of such thickness and dimensions, and laid in such manner as to thoroughly bond the wall, and also to give a firm and even bearing for the wall plates or bolsters of the bridge to be placed upon them."

"The face of the work for abutments or side walls of arch culverts, also of bridge abutments and piers, will generally be what is called "rock dressed;" and the whole work must be laid in full mortar, composed of the best hydraulic cement and good clean, sharp sand, the general proportions of which will be, one part of cement to two parts of sand, to be thoroughly mixed, and used within the proper time for rendering adhesion and solidification most perfect."

"All masonry laid in mortar must be well and nicely pointed up before it will be considered finished."

MONTREAL NORTHERN COLONIZATION RAILWAY (4 ft. 8½ in. Gauge.)

Extract from Specification.

GRADING.

" 11. The *width* of Embankment at *sub-grade* or *formation level* is *intended* to be fifteen feet ; the width of cuttings, as a general thing, *will not be less* than twenty feet, but they may vary according to the section of country and other circumstances, *as the Engineer may direct*," &c.

BALLASTING.

" The material to be used for *raising the road-bed to the final or full grade* or "*ballasting the road*," shall consist of coarse sand or free gravel, to be approved by the Engineer before being used upon the road. When material suitable for the purpose occurs in the excavation for the *road-bed*, or in close proximity to the road, the *ballasting* is to be done previously to the track being laid, for a distance each way of half a mile from the point of construction. When fitting material is not to be had as above, the track is to be laid at "*sub-grade*," and well packed up with clay &c., to prevent injury in the rails, and subsequently *be raised to full grade level*, the material for which will be hauled over the railway."

NOTE.—Attention is called to the *italicised* words and sentences, to show their *ambiguity*, as compared with the " N. S. R. Specifications."

S. S.

NORTH SHORE RAILWAY (4 feet 8½ in. Gauge.)

Extracts from the Specifications.

I. GENERAL PROVISIONS.

" The work will, in all cases be under the direct charge and control of the Engineer ; and his orders must be complied with in every respect, and under all circumstances. He will have power, and it will be his duty to reject, or condemn, at any stage or condition of the work, all workmanship or material, which, in his opinion may be imperfect or unsuitable ; and the same must be immediately corrected or replaced, to his entire satisfaction. He will also have power to discharge from the work, any foreman, mechanic, or laborer who may prove to be either incompetent, or disrespectful and riotous in his conduct ; and the person so discharged shall not be employed thereafter upon any portion of the work.

"It is intended that the materials and workmanship, both in the roadway, track, structures, buildings, and equipments, shall all be *first class*, so far as regards strength, durability, and practical adaptation. Nothing superfluous will be required; but every thing must be executed neatly, thoroughly and in good taste, so as not to offend the eye, nor convey an idea of carelessness or want of skill in execution

"Working plans, and specification more in detail, for the more important Mechanical Structures, Depot Buildings, Machine Shops, Engine Houses, &c., will be furnished by the Engineer, as they may be required from time to time, during the progress of the work.

IV. GRADUATION.

"1. The road-bed will be graded for a single track, except where depots, stations or sidings occur.

"2. The road-bed for single track will be not less than twelve feet in width at grade—but will be increased on embankments, according to height, or character of material, at the discretion of the Engineer.

"3. The grading will be made of such extra width, at stations and sidings, as the Engineer may direct.

"4. All excavations must be made sufficiently wide to allow of ample side drainage.

"5. The side slopes of excavations and embankments, which are composed of loose material, will generally be one and a half base, to one vertical—but they will vary from this, according to height, or character of material, at the discretion of the Engineer.

"6. The materials composing embankments must be entirely imperishable.

"7. Whenever the material found in road-bed, or side excavations is unsuitable for sustaining the permanent track, such other material shall be substituted as the Engineer may direct.

"8. Material found in excavations will generally be placed in embankments; but such material will be wasted, and other material borrowed for embankments, whenever directed by the Engineer.

"9. Spoil banks, and borrowing pits will be so made as not to disfigure nor interfere with the permanent road-way and slopes; and they must be dressed up in such form and dimensions as the Engineer may direct."

VI. MASONRY.

"1. The different varieties of stone work required for abutments and piers of bridges, arch and box culverts, open drains, cattle guards, slope and retaining walls, &c., must be executed in a

skilful and workmanlike manner, after the general plan of alternate headers and stretchers; and must be composed of durable well shaped stones, laid upon their broadest or quarry beds, and adapted to the formation of the different works or structures.

"2. Bridge abutments and piers, arch culverts, and the side walls of open drains, road crossings, or cattle passes exceeding five feet in height, will be laid in hydraulic mortar; and will correspond in character to what is generally termed first class rubble masonry. The face stone must be hammer dressed to good beds and joints, and pitched in, or scabbled, to a line, upon the beds and builds, corresponding with the finish line of the work. All angles that are exposed to view, must be cut clean and sharp with the chisel, to an arras of at least one inch in width, and laid to a perfect line. The work will be laid in courses, each of uniform thickness, when the quarry affords strata suitable for that purpose; but when this is not the case, it will be sufficient to build and level up sections of from two to four feet in height, as the Engineer may direct, with square well shaped stones of suitable size, brought to close joints, and free from spalls, both vertically and horizontally.

"3. The coping must be of proper and uniform thickness, neatly hammer dressed upon the face, beds, and vertical joints; the front angles must be cut square with the chisel, and the stone must be of sufficient width to give a good finishing bond to the work after projecting a few inches over the face of the wall. In cases where the coping forms the finishing course, or bridge seat for truss bridges, their upper surfaces will be dressed to a smooth and uniform plane; and they will be securely fastened to each other, and to the main wall, by means of strong iron clamps and dowels, whenever directed by the Engineer.

"4. The stones composing the arch, in culverts, must be placed perpendicular to the curve; and extend entirely through the thickness of the arch, and be dressed throughout to close beds and joints. These must be laid in regular courses of uniform thickness, and the inner faces dressed smoothly to a line with the hammer. The outer, or ring stone, must have an extra finish; and the key stone must be neatly cut with the chisel, and so placed as to project slightly from the face of the work.

"5. The mortar used in masonry must be composed of the best quality of hydraulic cement, mixed in proper proportions, with clean sharp sand; and applied to the work within the proper time for rendering the adhesion and solidification most perfect. When grout or concrete are used, they will be manufactured and applied under such special directions as the Engineer may deem applicable to the case."

"6. Box culverts, and open drains, sluices or cattle-guards, not exceeding five feet in height, will be of rubble masonry, and will generally be laid dry. The side walls must be laid up strong and

well bonded throughout, the upper course bonding the entire wall. The covering stone of box culverts must be entirely sound, and wide enough to extend at least two thirds across either wall ; and generally of a thickness equal to one half of the width or space to be covered. The end walls of box culverts must be laid with extra care and finish, the stone being of good beds and builds, with joints and angles clean and square, so as to be free from spalls. The coping must be of proper and uniform thickness, neatly hammer dressed on the face ; and so laid as to have a slight projection over the front wall, and to extend back so as to give a good finishing bond to the work. The ends of the side walls of open drains, &c., will be composed of square well shaped stones, laid in regular steps or offsets to correspond with the slope of the adjoining bank ; and so well bedded and fitted as to require no spalls or wedges to keep them permanently in place.

" 7. Slope and retaining walls will be laid at such angle, and of such thickness, as the Engineer may direct. The stone must be sufficiently massive and well bonded, to withstand the lateral thrust of the banks, and also any shock, or pressure to which they may be exposed upon the outer surface. The upper course must be as nearly uniform in thickness as practicable, and sufficiently wide to bond the entire wall.

SUPERSTRUCTURE.

" Neither the slopes, nor the road-bed must be disfigured or weakened, by taking material therefrom for filling in or adjusting the track.

" Whenever, in the opinion of the Engineer, the material composing, or contiguous to the road-bed, is unsuitable for ballasting the track, other suitable material shall be substituted therefor, and hauled in upon the track with gravel trains, until the same is thoroughly ballasted to the satisfaction of the Engineer.

NOTE.—For "*Explanatory or detailed Specifications*," see "Circular No. 2," contained in "*Appendix No. 7*."

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APPENDIX N^o 2.

REPORT OF THE CHIEF ENGINEER UPON THE CONDITION AND PROGRESS OF THE WORK.

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APPENDIX N^o 2.

NORTH SHORE RAILWAY.

REPORT OF THE CHIEF ENGINEER UPON THE
CONDITION AND PROGRESS OF THE WORK
UP TO DECEMBER 1st, 1874.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, Dec , 31st 1874.

MR. PRESIDENT :

It was my intention and desire, to accompany my last progress estimate of work done, &c., up to the 1st inst., with a statement showing the relative amount of work performed and the expenditures incurred by the Contractor, up to that date, as compared with the total amount of work to be done, and expenditures to be incurred, before the final completion of the contract, in order that the Board of Directors might form an intelligent opinion as to when the whole, or any portion of the road will probably be completed under the present contract.

I was prevented, however, from performing that duty by the very short time allowed me for the preparation of that estimate; and I therefore embrace the first opportunity to submit the following brief report upon that subject for the consideration of the Board of Directors, and for such action as may be deemed proper and expedient in the matter.

I will premise what I have to say upon this subject by stating the following facts:

1st. The charter of the company expires on the first day of May, 1877.

2nd. The present contract for the completion of the Main Line expires on the first day of December, 1876.

3rd. The contract for the completion of the Piles Branch expires on the first day of May, 1877.

4th. The schedule or relative contract value for completing the Main Line is \$6,100,000, and the Piles Branch \$900,000, making a total of \$7,000,000.

5th. The progress estimate up to 1st December, 1874, amounted in relative contract values, upon the main Line to 681,864.06. And upon the Piles Branch to \$19,095.68, making a total of \$700,959.74, or in round numbers, ten per cent of the total expenditure required to complete the entire road according to the terms of the contract, has been incurred during the past three working seasons.

6th. There had been expended by the Chicago Contracting Company upon the Main Line up to Jan. 1, 1874, in relative contract values, \$237,359.77, leaving to be expended after that date, \$5,862,640.23.

7th. The present Contractor, who has now had the control of the contract during one entire working season has upon the Main Line expended in relative contract values since Jan. 1, 1874, \$441,504.29, or in round numbers, less than eight per cent of the total expenditure required to complete the Main Line has been incurred during the past working season.

From the above statement of facts it would appear that the rate of progress made upon the entire road during the past three working seasons, will secure its completion within about thirty years from the date of the Original Contract.

It would also appear, that the rate of progress made upon the Main Line, during the past working season, will secure its completion within about twelve years from the date of the supplemental contract.

An impression has been made to prevail to some extent, in the minds of the Directors and the Public, that the road will be opened for business between Quebec and Three Rivers, before the close of the year 1875.

According to the schedule above referred to, a total expenditure, in cash values, of \$1,301,678.76 will be required to complete the fencing, clearing and grubbing, grading, foundations, masonry, bridging, and track superstructure, between the Cities of Quebec and Three Rivers, exclusive of Rolling stock, station buildings, machine shops, Palace Harbour, and all other items of expenditure.

There had been expended in cash values on account of the above items, up to the 1st December inst., \$199,393.30, or about fifteen per cent of the total amount, leaving, \$1,102,285.46 yet to be expended, which, at the rate of progress made during the past working season, will require about five and one half years to complete the track from the City of Quebec to Three Rivers,

exclusive of the other expenditures above referred to, a large amount of which will be required however, before this portion of the Road can be opened for business.

The supplemental contract provides that the work shall be recommenced and proceeded with uninterruptedly "to the satisfaction of the Chief Engineer of the Railway Company;" and it therefore becomes my duty to inform the Company that, up to the present time, the work has not proceeded at all to my satisfaction, and also that, so far as I can judge from the progress already made, and the preparations made, or likely to be made for the future prosecution of the work, I do not consider it at all likely that the road will be completed by the present Contractor, within the time specified in the contract.

Having become thoroughly impressed with this idea, some time before the close of the past working season, I addressed a letter to the Contractor upon the subject, on the 5th October last, of which the following is a copy:

OFFICE OF THE ENGINEER IN CHIEF.

Quebec, October 5th, 1874.

DEAR SIR,

Your contract for the construction and equipment of this Railway specifies, that:

"The work will in all cases be under the direct charge and control of the Engineer; and his orders must be complied with in every respect and under all circumstances," (the Engineer referred to being, as therein specified, "the Engineer in Chief of the North Shore Railway," &c., &c.)

Your supplemental contract also provides, that you "shall be bound, immediately after the signing of these presents, to recommence the construction of the said work, and to proceed with the same without interruption, to the satisfaction of the Chief Engineer of the said Company. If the said work should not be so recommenced, and proceeded with uninterruptedly within six months from the date of these presents, the Board of Directors of the said Company shall have the right, by giving notice to the said Hon. Thomas McGreevy, to cancel and annul the present contract."

In as much as the present working season is rapidly drawing to a close, I regard it as being within the strict line of my duty, in view of the responsibilities placed upon the Engineer in Chief, by virtue of the foregoing, as well as other provisions in your contract, to call your attention, at the present time, to some matters connected with the progress made during the present working season; and also to the present condition and future prospects of the work; in order that I may be prepared, at the proper time,

to report upon the same to the President and Board of Directors of the Railway Company.

At the commencement of the season, you informed me that you intended to procure the right of way, and to make such progress with the grading, masonry foundations, &c., between Quebec City and Three Rivers, during the present year, as would enable you to lay the track upon this portion of the road before the close of the next working season; and that you would probably not do anything this year west of Three Rivers, except perhaps to commence the foundations of the Ottawa bridge near Bout-de-l'Isle.

This programme seemed to me quite reasonable, inasmuch as you have until 1st December, 1876, in which to complete the entire Main Line of the road.

But I regret to say, that the progress made up to the present time is not at all satisfactory to me; and that it does not appear, in any degree, to justify the conclusion that the track will be laid between the Cities of Quebec and Three Rivers during the coming year.

In fact, unless a much greater degree of energy and order is immediately infused into the work, than has been shown thus far during the present season, I very much doubt whether this portion of the road will be completed before the Fall of 1876; and the remainder before the close of the following year.

In order to insure the completion of the road to Three Rivers, within the limits of reasonable economy, during the coming year, the light grading should have been all completed, and the heavy work well advanced, during the dry favorable weather which generally terminates, in this climate, with the close of September; instead of which, a large proportion of this work, consisting, in many instances, of comparatively light grading in swampy wet ground, has been allowed to remain untouched up to the present time.

The dry masonry in box culverts, and open drains, should all have been put in before the 1st October; instead of which, only one small box culvert has, so far as my knowledge extends, been so far completed as to allow of its being covered with earth; and, as a general thing, no stone has been prepared or delivered for these structures.

The foundations and masonry required for the Port Neuf, and other truss bridges, between Quebec and Saint-Annes, should have all been put in, and extended at least above high water-mark, during the present season; instead of which, no material progress has been made with any one of these structures, except perhaps at the Jacques Cartier River, where one pier is considerably well advanced.

The pile foundations for the bridges at the Saint-Annes, Batis-can and Saint-Maurice Rivers, should have all been put in, and

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the masonry extended up above high water-mark during the present season; instead of which, only the sinking of the first crib in deep water; and the excavation of the foundations for a single abutment have just been commenced at the Saint-Annes; and I am informed that no stone has as yet been quarried or delivered for the masonry.

With reference to this particular class of work, it is proper that I should inform you, that no crib and pile sub-structure or foundation, will be allowed to go in this Fall, unless there is a certainty that the masonry upon it will be carried up either above high water mark, or sufficiently high to hold the foundation firmly in its proper form and position, during the floods and ice jams to which it may be exposed during the coming spring freshets; and, also, that no cement masonry should be laid, in this climate, after the 1st of November, unless the weather should be more than ordinarily favorable.

The timber required for the superstructure of the bridges should all be provided during the present Fall and coming Winter, so as to be delivered upon the ground early next season; instead of which, I am not aware that any provision whatever has been made for the construction of these bridges, up to the present time.

The cross ties, or sleepers for the track, should also be provided and delivered along the line in large quantities, as early as possible next season, particularly at the east end of the road, where the track laying will commence.

Assuming that your average rate of laying and ballasting will be a half mile per day, and that you can rely upon twenty working days per month, you will require at least eight months to lay the track over the eighty miles between Quebec and Three Rivers, from which you will see that, at this rate, you would require the entire coming season in which to lay the track; and therefore, that your iron rails should be delivered upon the line at the opening of navigation; and also, that the grading and all mechanical structures should be entirely completed in advance of the track, in order that the track-laying may be commenced at the earliest possible moment, and proceeded with uninterruptedly; and that the ballasting may be completed before the road is opened for business.

The necessary engines and cars should also be upon the ground early in the spring, in order to facilitate the laying of the track; and work shops should be in readiness to keep this rolling stock in repair.

I regret to say that none of the necessary preparations above referred to, seem to have either been thought of, or provided for up to the present time.

On the contrary I feel compelled to state, that the administration of your contract thus far, seems to have been directed almost

entirely to an effort to destroy the efficiency of the Engineering Department, by insisting upon the right to appoint and control the different members of the staff, in direct violation of the intent and spirit of the contract. And also in a persistent effort to force upon the Railway Company, a class of work and materials, which are very much inferior to those specified and provided for in the contract.

With a view to this latter result, sub-contracts have been entered into for work and materials, the conditions of which are directly in conflict with the specifications attached to your contract with the Railway Company; and in many cases, I have reason to believe, these sub-contracts provide, that the work shall be executed under the direction of, and estimated by your own Engineers, instead of those referred to in your contract with the Railway Company.

A large amount of work has also been placed in the hands of inexperienced and irresponsible contractors, at prices considerably below the actual cost of the work; the result of which has been, that after placing in the work all of their own available means, and all the means and supplies, that they could raise on credit throughout the country, they have been compelled to abandon their work, and to leave behind them a large amount of liabilities.

The above policy has been persisted in to such an extent, that to-day, a feeling of doubt and distrust, not only towards yourself, but towards the Railway Company, and every person connected with the Road, pervades almost the entire community along the line, from the City of Quebec to Three Rivers.

The natural result therefore is, that the working forces have become demoralized; and the work itself is very far behind that stage of advancement which should have been reached during the present season, in order to secure either its completion to Three Rivers, during the coming year; or the completion of the entire road within the time specified in your contract.

In view of the whole subject, it really appears to me, that, if as much zeal had been manifested in the administration of your contract, towards carrying out its true intent and meaning, both with reference to the proper control of the Engineer Department; and to the character of the work therein contemplated and provided for, as appears to have been exercised in precisely the opposite direction, a very much larger amount of work would have already been accomplished, in a more acceptable manner; and at a considerably reduced cost to yourself.

I have thus given you, very frankly, although somewhat disconnectedly, my views as to the past management, present condition and future prospects of your work (which views are based upon a somewhat extensive and varied experience in matters of this kind) in the hope that they may prove to be of some

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service to you at the present time ; and also in the earnest desire that you may be induced to avail yourself of the few remaining weeks of the present working season, to correct some of the apparent errors herein referred to ; and at the same time, to place the work in a position that it will command the confidence, both of the Railway Company and the public, as to its character, progress and final completion.

Indulging the further hope that the suggestions herein contained may be received by you in the same spirit of kindness with which they are written.

I have the honor to remain,

Dear Sir,

Yours very truly,

(Signed,)

S. SEYMOUR,

Chief Engineer.

Hon. THOS. MCGREEVY,

Contractor of the

North Shore Railway,

Quebec.

The Contractor informed me, several days after the above letter was written, that he had received it, but had not yet found time to read it.

I have no reason to suppose that he has read it yet, or that he ever will read it ; because his entire policy seems to be based upon the theory that any suggestions of this kind are entirely foreign from the duties of the Chief Engineer ; and it therefore seems hardly necessary to state that no improvement in the management of the work was apparent, before the final close of the working season.

Having now relieved myself from any further responsibility in the matter, by placing the foregoing facts, together with the conclusions which I have based upon them, in your hands, for the consideration of the Board of Directors.

I have the honor to remain,

Mr. President,

Your Obt. Servt.,

(Signed) S. SEYMOUR,

Eng. in Chief.

Col. Rhodes,

President., N. S. R. Co.,

Quebec.

The Chief Engineer to the Secretary.

Quebec, January 12th, 1875.

DEAR SIR,

You will please find herewith, progress estimate No. 6, for the Main Line, extending up to the 1st instant.

Before this estimate, or any portion of it is approved by the Board of Directors, I consider it my duty to call their attention to some matters of considerable importance connected with this and former progress estimates.

The provisions of the contract, with reference to these estimates are that they shall be based by the Engineer, and paid by the Company upon the relative schedule contract values of the different items embraced therein, as made and certified by the Chief Engineer of the Railway Company.

On June 11th, 1874, the Contractor applied to the Company for a change in the basis of payments, as follows: "I have therefore to request that you will apply to the Government and the Corporation to pay over their bonds to the extent of five hundred thousand dollars each, in the ratio of one third each on the cash value of each progress estimate of work done, the remaining third to be paid in the Bonds of the Company."

The Railway Company made the application as requested; and it is understood that the Provincial Government, and the City Council of Quebec, have agreed substantially to the terms proposed by the Company in behalf of the Contractor.

I do not understand however, that the terms of the contract have ever been changed, or that the Railway Company has ever taken any further action in the matter, except to notify the Provincial Government and the City Council, that the modified terms, as agreed to by them respectively, are acceptable to the Company; although I believe the progress estimates, for the Main Line, have all been approved by the Board of Directors upon a cash, as well as a relative contract basis, and that payments have been made to the Contractor accordingly.

Inasmuch as this change in the basis of payments involves a very important change in the terms of the contract; and one which is exceedingly beneficial to the Contractor, I would respectfully suggest that before any further payments are made upon this basis, the modification should be put in regular form by the respective parties to the contract; and that the Chief Engineer should be duly notified thereof, so that his estimates may be returned accordingly.

Up to the present time, my progress estimates have shown both a cash, and a relative contract value; the cash value being merely one that was assumed, in the preparation of my schedule, for the

purpose of arriving at relative contract values that would aggregate seven million dollars for the entire contract. These cash values cannot therefore be fully relied upon as representing the actual cash expenditure upon the items that are computed by quantities in the estimates. My own opinion is that the rates assumed in my last schedule, for items of this class, afford the Contractor an average profit of from fifteen to twenty per cent.

At even ten per cent, the aggregate of these items, in the present estimate would amount to \$22,026.89, in cash value and \$33,040.33 in relative contract values, over and above the cash expenditure of the Contractor on their account.

The reason for my adopting these rates in the schedule, was to cover any increase, or change, which might occur in the quantities, or relative cost of the items, during the progress of the work; and it was therefore not intended nor anticipated that these rates would be adopted, as they seem to have been by the Government and City Authorities, and also by the Railway Company, as representing the actual expenditure by the Contractor. And I do not feel willing that the system should be continued, without placing on record such an explanation on my part, as will relieve me from all responsibilities in the matter.

The Contractor has informed me that he shall pay only a portion of the Engineering expenses for the month of December. These expenses, amounting to \$3,092.33, as approved by me, are included in the present estimate, and it will therefore be for the Board to decide whether the estimate shall be paid before the Contractor has made provision for the payment of these expenses, as required by the contract. I should have felt justified in withholding the estimate entirely, after receiving this notice from the Contractor, but I thought it more advisable to leave the matter in the hands of the Directors.

The Contractor still refuses to furnish me with any assurance respecting his ownership and control of the items embraced in the estimate under the head of "materials delivered and ready for delivery;" and I must therefore again refer the Board to my letter upon that subject dated December 12th, 1874, which accompanied my last estimate. And also to a detailed statement of the items, which accompanies this estimate, from which it will be seen that they aggregate \$23,220.88 in cash values, and \$33,831.32, in relative contract values.

Not desiring to appear in constant antagonism to the Contractor in this or any other matter connected with the progress estimates, I would respectfully ask the Board for some definite instructions upon this subject, in regard to future estimates.

The Contractor has made a claim for an allowance, in the last and present progress estimate, on account of interest upon Bonds and Debentures received or earned by him, on account of previous estimates.

Feeling quite clear, in my own mind, that the time had not yet arrived when such an item was admissible in the estimates, I applied to the Secretary for an opinion upon the subject from the legal advisors of the Company; and as this opinion coincided entirely with my own, the item was not entered in the previous estimate.

I have since received the following copy of a resolution passed by the Board on 12th December, 1874:

Resolved, "That in the opinion of this Board, the Contractor is entitled, in equity, to interest on Bond or certificates for Bonds, to be paid every six months; and that the Engineer in Chief be instructed to include interest on his estimates for the future."

Having been officially informed by the Secretary, that no payments had been made to the Contractor, either in "Bonds or certificates for Bonds" prior to Oct. 1st, 1874, and therefore that no demand for interest could have occurred upon such payments, this item does not appear in the present estimate.

The contract clearly provides that the Contractor shall pay the interest on the "first preference Bonds of the Company only;" and also "the interest as it may become due upon the stock certificates" of the City of Quebec, which may be received by the Contractor for work done under the contract. And it is equally clear that it is the duty of the Chief Engineer to include, in his progress estimates, any and all payments which may be made by the Contractor on that account, under the general head in the schedule, of "Interest on Bonds and Debentures." But I do not conceive that there is any provision in the existing contract by which the Engineer would be justified in estimating, either the interest on the expenditures of the Contractor; or the interest upon the securities above named, before an instalment of this interest either becomes due, or has been paid by the Contractor.

Inasmuch as copies of my monthly or progress estimates are furnished to the Provincial Government and the City Council of Quebec, as a basis for their Engineers to arrive at and certify to the amounts payable by them respectively, on account of legitimate expenditures upon the road; I would respectfully request that copies of such communications as I may make to the Company, in explanation of any items contained therein, may also be furnished with these estimates.

I have the honor to remain,

Mr. Secretary,

Yours very truly,

(Signed), S. SEYMOUR,
Eng. in Chief.

A. H. VERRETT, Esq.,
Secretary N. S. R.,
Quebec.

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APPENDIX N^o 3.

CORRESPONDENCE RESPECTING WORK
AT RIVER ST. ANNES.

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APPENDIX No. 3.

CORRESPONDENCE RESPECTING THE FOUNDATIONS AT RIVER ST. ANNE.

Chief Engineer to Contractor.

(Extract from Letter of 5th October.)

"The pile foundations for the bridges at the Saint-Annes, Batis-can and Saint-Maurice Rivers, should have all been put in, and the masonry extended up above high water mark during the present season; instead of which, only the sinking of the first crib in deep water; and the excavation of the foundations for a single abutment have just been commenced at the Sainte-Annes; and I am informed that no stone has as yet been quarried or delivered for the masonry.

With reference to this particular class of work, it is proper that I should inform you, that no crib and pile sub-structure or foundation, will be allowed to go in this Fall, unless there is a certainty that the masonry upon it will be carried up either above high water mark, or sufficiently high to hold the foundation firmly in its proper form and position, during the floods and ice jams to which it may be exposed during the coming spring freshets; and, also, that no cement masonry should be laid, in this climate, after the 1st of November, unless the weather should be more than ordinarily favorable."

ENGINEER DEPARTMENT OF THE NORTH SHORE RAILWAY.

Three Rivers, Oct., 8th 1874.

HON. THOS. MCGREEVY,
Contractor N. S. R.

Quebec,

DEAR SIR,

In reference to Ste. Anne and Batiscan Bridge foundations, the Chief Engineer's instructions are, that no foundations are to be put in this season, except such as can be secured by the masonry being built to ordinary high water level during this season.

In my opinion, the action of the ice (caused by the tides) and

the next spring freshet, will cause serious damage to any foundations, which may not be properly secured as advised, and consequently must retard the progress of the work next season.

I am,

Your obedient servant,

(Signed,) L. B. HAMLIN,
Resdt. Engineer.

Ste. Anne de la Pérade, Oct. 25th, 1874.

G. W. BUTTERFIELD,

DEAR SIR,

The piles are driven in both cribs and all ready for the saw. The timber all hewn for platforms. The foreman tells me to-day, that the saw will not be ready before two weeks, if this is so, the work that is done, I am afraid will be lost, if the piles are not cut this fall they will be destroyed. The work is going on slow. Will commence driving on No. 5 to-morrow. Abutment foundation very slow. All well.

Yours in haste,

(Signed,) A. L. SMITH,
Inspector.

Chief Engineer to L. B. Hamlin.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, Oct. 26, 1874.

DEAR SIR,

Your letters of the 23rd and 24th inst., respecting the driving of piles at the Batiscan River, have been received and answered substantially by telegraph.

I have promised the Contractor that the piling and cribbing could go on for the present, upon his assuring me that it should be thoroughly protected against ice, floods, &c. But I shall expect you to see that the piles are sawed off, the cribs filled with stone, the platforms put on, and loaded properly with stone before the Rivers freeze over.

You should have a separate Inspector for each River; and I have telegraphed Mr. Chandler to send you one from Montreal by the name of McDonald. Until he arrives you must improvise one for the occasion.

Yours truly,

(Signed,) S. SEYMOUR,
Chief Engineer.

L. B. HAMLIN, Esq.,
Resdt. Engr. N. S. Ry., Three Rivers.

Contractor to the Chief Engineer.

CONTRACTOR'S OFFICE.

Quebec, 9th November, 1874.

GENL SEYMOUR,

Chief Engineer N. S. R. R.

DEAR SIR,

I had directed, in order to secure as early completion of the work as possible that the men employed at the piling and protection of St. Annes River should proceed with the work without delay. The Engineers in charge have prohibited them from proceeding with the piers in the river on the ground, as they allege, that they might be carried away during the coming winter. I desire to inform you that in doing this work, or other works. I am fully alive to the responsibility attached to it; and am prepared to assume all the risks attached to proceeding with the work at this or any other season.

I am yours truly,

(Signed), ROBERT H. MCGREEVY,
For the Contractor.

Chief Engineer to L. B. Hamlin.

OFFICE OF THE ENGINEER IN CHIEF.

Quebec, Nov., 10th, 1874.

DEAR SIR,

You will find enclosed a copy of letter just received from R. H. McGreevy for the Contractor, in which he states that he is prepared to assume all the risks attached to proceeding with the work (at the St. Annes River) at this or any other season, and you will therefore be governed accordingly.

Yours truly,

(Signed), S. SEYMOUR,
Chf. Engr.

L. B. Hamlin, Esq.,

Resdt. Engr. N. S. Ry.,

Three-Rivers.

J. B. Brophy to Mr. Hamlin.

St. Annes, 25th Nov., 1874.

L. B. Hamlin,
Resident Engineer,
Three-Rivers.

DEAR SIR,

Yours of the 23rd inst. just received. I expected to have seen you before leaving 3 Rivers and should have gone out to your house for that purpose, but being Sunday did not know if you would care about talking business.

On Wednesday last they had got their sawing apparatus in position and cut off one pile 2' 10" below surface of water, which was about 10" higher than the low water elev. established, and Sampson said they were prepared to cut off all the piles at that elevation, if I would receive them as finished, which of course I declined doing, and told him he might cut them off there if he chose, with the understanding they should be cut again at the proper elevation. I told him the crib would have to be lowered either by taking off the top timbers, or driving it with pile driver; which he refused to do without guarantee of extra pay. They could not possibly have cut the piles at the proper depth even if the crib was not too high, as their saw could only work about 32" under water, as they had it arranged.

There were also several other defects in the machine which precluded their cutting the piles in a proper manner.

As far as I can understand the matter, they did not want to go on with the work, and seized the first shadow of a pretext for abandoning it.

The pile driving on the Island was progressing satisfactorily and they abandoned that also without any reason that I am aware of.

Mr. Normand accuses every one connected with the work of trying to cheat him, and says he was obliged to stop work on that account.

I don't know of any way to have a pile driven at Batiscan, as there is no one here to do it.

The pile driver is still there, but would require five or six men and an Engineer to run it.

I enclose force account for last week and should have sent it before but thought the account sent last Friday would be sufficient.

I remain,

Yours very truly,

(Signed), J. B. BROPHY,
Asst. Engr.

Chief Engineer to the Contractor.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, November 26th, 1874-

DEAR SIR,

You will please find enclosed a copy of despatch just received from Mr. A. L. Smith, Inspector at St. Annes, from which you will see that the work at that place is already receiving injury from the action of the ice.

I also beg to inform you, that although you have assumed all the risks connected with doing this work in your own time and way, instead of following the advice and directions of myself and the Resident Engineers, I shall not feel justified in continuing this item in future estimates, unless I am fully satisfied that the work already done is protected against injury, so as to be fully available next season. I would also call your attention to what Mr. Smith says about his pay, board bills, &c.

Yours truly,

(Signed,) S. SEYMOUR,
Chief Engineer.

Hon. THOS. MCGREEVY,
Contractor, &c.

Telegram above referred to.

ST. ANNES, NOV. 26, 1874.

GENL. SEYMOUR, N. S. RY.--I find this morning 3 piles drawn by the ice outside of work, think they will draw out of the work soon if the ice is not kept clear from them. I have been here two months and not paid. Board bill not paid at all. Have no money to get home with, answer.

(Signed), A. L. SMITH,
Inspector.

Contractor to the Chief Engineer.

CONTRACTORS OFFICE.

Quebec, 26th Nov., 1874.

GEN. S. SEYMOUR,

Chief Engineer N. S. R. R. Co.

DEAR SIR,

Yours of this date enclosing copy of telegram from A. L. Smith, Inspector, has been received. At the moment I can only reply that

should any damage arise to the piles from any cause, it is you and your Engineers and Inspectors who are responsible. This arises from the fact that all possible obstacles have been put in the way of carrying out the work to proper advantage and security. To go further into this subject would entail a lengthy correspondence for which I have not now sufficient spare time. I think it is a matter for investigation by disinterested parties, which with your consent, I am prepared to submit it to. In reply to your letter of the 20th instant, as well as to others which I will do in the course of a day or two I will refer again to this matter.

I enclose copy of Mr. Normands letter received Yesterday.

I am, yours truly,

(Signed),

ROB. H. MCGREEVY,

For the Contractor.

Mr. Normand to Mr. McGreevy.

Three Rivers, 23rd Nov. 1874.

THOS. MCGREEVY, Esq.,

Contractor North Shore Railroad.

SIR,

As I told you the other day during the interview I had with you at Quebec. I have stopped the work at St. Ann. After having had an understanding with Smith the Superintendent to cut the piles two feet ten inches under water, the next day Engineer Brophy objected to their being cut at that height and it is impossible for me to cut them lower down because there is but three feet above the caisson, and moreover this caisson was made after their plans and to their satisfaction.

In view of all this annoyance, the last act seeming to me to crown all the others, and seeing the advanced period of the season, I have stopped the work and have put everything into winter quarters.

I am yours, &c.,

(Signed,)

J. B. NORMAND.

Chief Engineer to R. H. McGreevy.

OFFICE OF THE ENGINEER IN CHIEF.

Quebec, Nov. 24th, 1874.

DEAR SIR,

I beg to acknowledge the rect this morning of your favor of the 26th inst., relating to the stoppage of work at the St. Anne's River, and to state that it contains the first intimation which I have received from any source, that there was any difficulty or misunderstanding between your workmen and my Engineers and Inspectors, in regard to the manner of executing the work. I have therefore sent the following message to Mr. Hamlin, at Three Rivers: "Why was work at St. Annes stopped, please answer fully and immediately by telegraph."

I shall also enclose him by mail a copy of Mr. Normand's letter, and an extract from yours, and request him to report upon the subject immediately. I will send you his replies as soon as received. In the mean time, you have my full consent to institute any investigation you may think proper, respecting this or any other portion of the work.

Yours very truly,

(Signed),

S. SEYMOUR.

L. B. Hamlin to the Chief Engineer.

Telegram from Three Rivers, November 27th, 1874.

GENL SEYMOUR,

Engineer in Chief, N. S. Ry.,

Quebec.

Work stopped at St. Annes, will report fully to morrow.

(Signed),

L. B. HAMLIN,

Chief Engineer to L. B. Hamlin.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, Nov. 28th, 1874.

DEAR SIR,

I enclose copy of letter just received from the Contractor, and also one from Mr. Normand to the Contractor, respecting the stoppage of the work at St. Annes River, and have to request that

you will, without delay, furnish me with all the facts in the case, supported by the properly authenticated statements of Mr. Brophy, Asst. Engineer, and Mr. Smith, Inspector of the work.

It seems to be exceedingly strange that there should have been so much trouble and misunderstanding respecting this work, for some weeks past, and that I should have heard of it just now from the Contractor for the first time. I have been endeavoring for the past week or ten days, both by letter and telegraph to obtain some information upon the subject, but in vain.

Yours truly,

(Signed,) S. SEYMOUR,

L. B. HAMLIN, Esq.,

Resdt. Engineer,

Three Rivers.

L. B. Hamlin (Resdt. Engr.) to Chief Engineer.

ENGINEER DEPARTMENT OF THE NORTH SHORE RAILWAY.

Three Rivers, 28th Nov., 1874.

Genl. Seymour,

Eng. in Chief. N. S. Railway,

DEAR SIR,

In reference to the suspension of work at St. Annes. Mr. Normand (who was apparently in charge) stopped every thing on the 20 inst. Mr. Brophy immediately reported to me (but owing to the usual fatality which appears connected with all communications from or to St. Annes) it only reached me on Wednesday last, and I reserved reporting until obtaining full information on the subject. The machinery for cutting off the piles with its appliances is deficient to comply with the specifications.

The foreman in charge of the work, wanted to cut off the piles 2" 10' below the water at its present elevation, which is 10" higher than our established low water elevation.

Mr. Brophy refused to accept the work as finished and all operations were stopped next day.

Yours truly,

(Signed) L. B. HAMLIN.

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Chief Engineer to R. H. McGreevy.

OFFICE OF THE ENGINEER IN CHIEF.

Quebec, Nov. 28, 1874

DEAR SIR,

I beg to hand you copy of answer just received from Mr. Hamlin to my telegram sent this morning in relation to the work at St. Annes, from which you will see that I am to have full report on Monday.

Yours truly,

(Signed) S. SEYMOUR,

R. H. McGreevy, Esq.,

For the Contractor.

("Copy") "Machine for cutting piles inefficient, and foreman refused to comply with Engineers instructions. Full report will reach you Monday morning.

(Signed), L. B. HAMLIN,

L. B. Hamlin to the Chief Engineer

ENGINEER DEPARTMENT.

NORTH SHORE RAILWAY.

Three Rivers, 5th Dec., 1874.

GEN. SEYMOUR,

Eng. in Chief, N. S. Railway.

DEAR SIR,

In reply to yours of the 28th ult., (enclosing copies of letters from Messrs. McGreevy and Normand), I must say that I know of no unjust interference of myself or any of my Staff, with the progress of the work at St. Anne's. We have simply endeavored to carry out the work in accordance with the specifications and your instructions.

I herewith enclose a copy of letter received from Mr. Brophy, which seems to explain the cause of the work being stopped, more fully than anything I can explain in the matter. In reference to the crib protection being now higher, by five inches, than when it was placed. It could only be caused by the driving of the piles which must have pressed out the ground and raised it. The men in charge of the work were recommended to lower it, either by

taking the top timbers off, or using a pile driver to press it down to its proper position. The latter plan I think would have answered all purposes, and been very inexpensive, however, according to Mr. Brophy's statement, even were the crib in its proper place, the saw with its present appliances would not have cut off the piles at the proper elevation. In my opinion the saw will work admirably when properly adjusted for the purpose. When the men in charge found it was not, they wanted to do the work their own way and force us to accept it, which being refused the work was immediately suspended. I shall make further inquiries into the affair, and communicate to you anything that I may learn.

Yours truly,

(Signed), L. B. HAMLIN,

J. B. Brophy (Asst. Engr.), to Mr. Hamlin (Resdt. Engr.)

[Extract.]

St. Anne's, Dec. 7th, 1874.

L. B. HAMLIN,
Resident Engineer,
Quebec.

DEAR SIR,

"Your letter of the 5th inst., I received last night and in reply beg to report as follows:

The work at St. Anne's commenced on the 26th Sept., and was abandoned on the 20th Nov. The details of work executed to the latter date, are as follows:

Excavation in foundations. Each abut. excavated to low water elevation. Pier No. 5 excavated to low water elev. Pier No. 6 to low water elev. Pier No. 1, west branch excavated to 1 foot above low water elev. Draw bridge Pier. 65 Piles driven. Pier No. 1, 99 piles driven. Pier No. 5, 91 piles driven and Pier No. 6, 10 piles driven.

The materials delivered and prepared, are returned in the estimate, and I presume it is not necessary to repeat the items here. The piles in draw bridge Pier, have not been straightened up into line. Those in No. 1 Pier, have been brought into place, with the exception of one pile, which the foreman said he could not bring into position, as he had not the proper appliances to do it. This crib is partly filled with stone. The crib work in the draw-bridge Pier; and also in No. 1, Pier, is too high to allow the piles to be cut off at the proper elevation, with the apparatus they have for that purpose. This no doubt is partly owing to the extra height put on the cribs to allow for settling in the bed of the River; but as far as I could ascertain, they have not settled at all,

but on the contrary appear to have risen some, particularly the draw-bridge pier crib, which is 16 inches too high on one corner, and we only allowed 8 inches for settling.

The top of No. 1 crib is only 5 inches too high on the South end, the rest is about the right elevation. That is about all I have to report concerning the St. Anne work, excepting what I have already reported to you in my letter of the 25th November, in regard to the stoppage of the work, and which I suppose is unnecessary to report here."

I remain,

Yours very truly,

(Signed,) J. B. BROPHY.

Report of Mr. A. L. Smith, Inspector, upon the quality and quantity of work done at the St. Annes River, from the 28th September to 30th November, 1874,

Quebec, December, 31st, 1874.

G. W. Butterfield,
General Assistant,
Quebec.

DEAR SIR,

I have been instructed by the Chief Engineer through yourself, to give my views, as to the work done at the River St. Annes foundations during the time that I remained in charge of that work.

On the 26th September last, I was appointed by General Seymour, Chief Engineer, as Inspector of cribs and pile driving at the St. Annes River, on the 2nd Residency, in charge of Mr. L. B. Hamlin, Resident Engineer, with orders to leave Quebec and be on the work as soon as practicable.

I reported at St. Annes on Monday morning 28th September, and inspected the work which had been commenced on the Turn Table crib. This work was in charge of Mr. Sampson, Superintendent, who had the plans; and upon examination, I found that the crib was built substantially, and in accordance with the plans, &c.

The following materials were in this crib:

12 pieces	34	feet in length	—	408	Lineal feet.
8 do	26	" do	—	208	" "
3 do	12	" do	—	36	" "
4 do	26	" do	—	104	" "

Total..... 756 Lineal feet.

The platform is prepared to be put on the crib when the piles are ready to receive it, in order to hold the ballast in proper place; and also to prevent all waste outside of the crib. There are also 324 ft. B. M. of plank and 256 lbs. of spikes to be used in this crib.

When the crib was completed it was taken to the east side, and placed in position on the bottom of the River, according to the lines given by Mr. J. B. Brophy, Asst. Engineer, in charge, where it now stands.

There have been 65 piles 20 ft. in length driven inside of the crib. The said piles are not put in line nor ballasted.

The crib has only ballast enough to sink and hold it on the bottom of the River. I did not reject or condemn any of the above work while it was being constructed.

The men worked steady while employed; and they were not delayed by the Engineer or myself, on the contrary, every thing was done on my part to forward it.

Crib No. 1.

This crib was well, and strongly built, according to the plan furnished by Mr. Brophy, and was built so as to contend against all freshets.

The following materials were used in this crib.

14 pieces	25 feet in length	—	350 Lineal feet.
8 "	45 "	—	360 " "
2 "	19 "	—	38 " "
4 "	14 "	—	64 " "
2 "	14 "	—	28 " "
2 "	10 "	—	20 " "
4 "	12 "	—	48 " "
4 "	4 "	—	16 " "

Total..... 924

Flooring..... 279 ft. B. M.

Spikes..... 376 Pounds.

Ballast for sinking..... 8 Yards.

The crib when finished was placed upon the lines given by the Engineer, on bottom of the River, to the entire satisfaction of the Engineer and myself; and all was done on our part to forward the work.

The crib was not loaded as it should have been, and it was understood at that time between Mr. Sampson and myself, that when the piles were driven, both cribs were to be completed, and the piles straightened, before the pile driver was taken away. But the pile driver instead of remaining to straighten the piles, was taken to the shore where it remained for weeks, and nothing was done to place the piles in their proper position.

At this time new machines were being built for the work to be commenced on the Island.

This is the time that the work of straightening the piles and ballasting the Turn Table and No. 1 crib, should have been done, according to the understanding between Mr. Sampson and myself as above referred to. I can give no reason now for the delay of this work, unless it was on the part of the Contractor, or that he did not intend to finish it. I gave Mr. Normand, and the Foreman, my copy of the specifications to read, and they told me that they understood them perfectly.

I went with Mr. Sampson, and showed him six piles in this crib (No. 1) that were not in line. He marked them with white chalk, and told his foreman to straighten them. Five have been put in line, but the sixth has not. These piles are partly ballasted, but not according to the specifications.

I accepted the piles as driven, but not as in line, ballasted or ready for the saw.

Foundation No. 5 (on the Island.)

The piles in this foundation are all driven in a good workman, like manner, and are accepted as such the number and lengths are as follows :

10 feet in length.....	26 piles
15 " "	42 "
20 " "	23 "
Total.....	91 "

Foundation No. 6 (on the Island.)

4 piles.....	10 feet in length
6 "	15 " "

These piles are accepted as driven.

When the saw came, it was placed in front of the pile crib in No. 1 with the intention of cutting off the tops of the piles, provided the saw would work.

Mr. Sampson asked me the privilege of trying the saw at high elevation, in order to fit it to its proper bearing, so as to save time and expense, which was granted ; but when the saw was tried it was found that it would not cut the piles off square. He then asked me to let him saw off the tops of the piles at the elevation of the work ; and when they were ready to cut the piles, he wished to cut them at the right elevation, I refused both to him for the following reasons :

- 1st. The saw would not cut the pile off square.
- 2nd. The crib was found to be too high, and
- 3rd. The spindle of the saw was too short.

Mr. Sampson said that they would cut the piles at high eleva-

tion in order to protect them from the ice, (this he told me, was R. H. McGreevy's orders) I consented to this. But when they got ready to cut them, they wished to cut them at right elevation, this was also refused for the reasons given above.

Here the work stopped, the cause of which I could not find out. Mr. Brophy nor myself knew nothing of it until the men were packing up to leave; the only thing we could find out, was that it was Mr. Normands orders.

The work was greatly delayed, owing to break downs of the machinery; and men were kept on the work that amounted to nothing. They put on box pumps to pump out the pits, which was of no use; (these pumps were only about 4 inches square) one man would pump awhile, then another would spell.

Mr. Sampson said that Mr. McGreevy was to furnish steam pumps but had not; and that he had to keep his men to work.

Another great invention to forward the work were tin pumps, to pump the water from the abutment foundation. They pump the water from one barrel into another, from the last barrel to the conductor, and from the conductor to the river.

If they had put men to lining and ballasting the cribs, the work could have been completed and accepted; and there is no reason, that I know of why they did not do it. I asked why the piles had not been put in line and ballasted, but could never get a satisfactory answer, only "that they would be all right before they were cut off." The total amount of prepared materials is in the hands of Mr. L. B. Hamlin, at Three Rivers.

Yours very truly,

(Signed) A. L. SMITH.

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APPENDIX N^o 4.

STATEMENT OF ENGINEERING EXPENSES.

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APPENDIX No. 4.

NORTH SHORE RAILWAY.

Statement of Engineering Expenses upon the Main Line, up to December 1st, 1874.

In 1871, the entire line was surveyed by four field parties, for the purpose of obtaining County subscriptions.

The total expenses of the Company up to the date of the contract, April 5th 1872, were \$42,534.28 of which \$19,303.28 were on account of Engineering, being 45 per cent of total expenditure up to that date.

In 1872, the entire line was re-surveyed by four field parties, for the purpose of obtaining the best Engineering route.

The total expenditures up to December 31st, 1872, were \$95,324.92, of which \$66,855.71 were for Engineering, being 70 per cent of the total expenditure up to that date.

In 1873 a portion of the line, between Three Rivers and Montreal, was re-located by one field-party, for the purpose of improving the line near St. Bartholemi Church ; and changing the crossing of the Ottawa Branch at Bout de L'Isle.

The total expenditures up to December 31st 1873, were \$158,239.85, of which \$91, 257.71 were for Engineering, being 58 per cent of the total expenditure.

In 1874 the entire line has been re-located by three field parties, for the purpose of re-setting the stakes, preparatory to construction, and procuring the right of way ; and also to make some improvements in the line, which have been found practicable and expedient.

An organization has also been kept up for the purpose of supervising construction, between the Cities of Quebec and Three Rivers.

The total expenditures up to December 1st, 1874, were \$454,576.04, of which \$129,699.35 were for Engineering; being 28½ per cent of the total expenditure.

The amount expended from January 1st 1874, to December 1st 1874, was \$296,336.19 of which \$38,411.64 was for Engineering, being 13 per cent of the expenditure.

Of the amount expended in 1874 for Engineering, \$17,000.00 was for re-locating the line; and \$21,411.64 was for purposes of construction.

The amount expended on account of construction proper, up to December 1st, 1874, was \$236,406.94, of which \$21,411.64 was for Engineering, being 9 per cent of the expenditure.

The total cash value of constructing the Main Line, as per Schedule, is \$4,066,666.67, of which \$255,513 is for Engineering, being 6½ per cent of the total expenditure.

RECAPITULATION.

	TOTAL.	Engineering.	per cent.
Expended up to April 5th 1872....	\$ 42,534.28	\$19,303.28	45
“ “ Dec. 31st, 1872....	95,324.92	66,855.71	70
“ “ Dec. 31st, 1873....	158,239.85	91,257.71	58
“ “ Dec. 1st, 1874.....	454,576.04	129,699.35	28½
“ from Jan. 1st to Dec. 1st, 1874.	296,336.19	38,411.64	13
“ on construction to Dec. 1st, 1874	236,406.94	21,411.64	9
Total Schedule cost.	4,066,666.67	255,513.00	6½

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EXPLANATORY REMARKS.

To persons who are not familiar with accounts of this kind, the foregoing Statement will appear somewhat novel, particularly when considered with reference to the variable nature of the ratios existing between the amounts of total expenditures, and those of Engineering, during the different stages of progress or advancement of the line towards completion. But when it is considered that all the necessary surveys must be made for the final location of the road, before the construction account can be commenced and carried on to any considerable extent, the reason for the increase in this ratio of expenditure up to that particular point of time, will become quite apparent. And it will also become equally apparent, that, when the work of construction is commenced in earnest, and prosecuted with vigor, this ratio will diminish quite as rapidly, until it reaches its minimum, at the final completion of the road.

An examination of the foregoing tabular recapitulation of the result thus far upon this road, affords a striking illustration of this principle.

It will be seen that the percentage had reached its maximum (70) when the location of the line had been substantially completed at the close of 1872. That it had been reduced to 58 at the close of 1873, when the present Contractor assumed the work. That it had been reduced to 28½ by the expenditure on account of construction during the past working season, up to Dec. 1st 1874. That it was reduced to 13 upon the total expenditure made by the present Contractor during the past year up to 1st December, which included the Company's expenses, right of way, re-location of line, supervision of work, contingencies, &c. That it was still further reduced to 9, upon the actual expenditure on account of construction up to Dec. 1st, 1874. And that, if the road is completed, according to the terms of the contract, it is quite sure to reach its minimum of 6½ per cent, at the close of the contract.

Another equally arbitrary, and self evident principle will also be found to govern all expenditures of this nature, which is, that they are increased in the ratio of any delays that may occur in the progress and final completion of the work.

As an example of the effect of this principle upon this road up to the present time, it is proper to mention, that the entire expenditure, amounting to \$42,534.28, previous to April 5th, 1872, (the date of the contract) was practically thrown away. Also that the entire expenditure made in 1873, amounting to \$62,914.93, was of no practical use whatever in advancing the work, making a total of \$105,449.21, of which \$43,705.28, was chargeable to Engineering, which has practically been lost to the Company, and consequently to the Contractor. And yet, it is quite apparent,

that the circumstances, as they existed at the time, fully justified these expenditures ; and also, that if they had not been made, the road could not have reached even its present state of advancement ; and perhaps it would have remained in substantially the same state of non-entity that it occupied previous to 1871.

Another example of the effect of this principle, will be found in the experience of 1874.

When the present Contractor assumed the work, in January 1874, he gave notice that he should commence operations vigorously in the Spring, upon a scale that would secure the completion of the road from the City of Quebec to Three Rivers, before the close of 1875.

To carry out this programme would involve the expenditure of about \$750,000 in actual construction, during each of the two working seasons, 1874 and 1875 ; but as the expenditure on that account has been only about one third of that sum during the past working season ; and as the Engineering organization in charge of construction, was necessarily quite adequate to the supervision of the required expenditure of \$750,000, it will be seen that, if that amount had been expended by the Contractor during the past working season, the percentage of Engineering chargeable to construction, would have been 3 instead of 9 per cent, up to the 1st December 1874 ; and proportionately less upon the entire expenditure up to that date.

The preliminary expenses of the Company, as well as the expenses of location, having now been closed substantially, the conclusion seems to be quite clear, that the Contractor has only to push forward the work to completion, within the shortest time practicable, in order to reduce the ratio of Engineering expenses to their lowest possible limit.

S. SEYMOUR,
Chief Engineer.

Quebec, December 31, 1874.

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APPENDIX No. 5.

CORRESPONDENCE WITH MR. SHANLY.

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APPENDIX No. 5.

CORRESPONDENCE WITH MR. SHANLY.

The Chief Engineer to Mr. Shanly.

NORTH SHORE RAILWAY.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, February 17th 1875.

My Dear MR. SHANLY,

I really hope you will pardon me for troubling you again about matters relating to this road ; but you will place me under additional obligations by responding to my call once more in a matter of very great importance to myself personally ; and I think one upon which depends the entire future of this Road, in the success of which I know you have always taken a deep interest.

To be very brief, the matters in dispute here, which it was first proposed to submit to you for advice, &c., and which were afterwards referred to Mr. Sandford Fleming, consisted mainly in differences of opinion between the Contractor and myself, with reference to the true meaning of the contract.

1st. As to the right of the Chief Engineer to control the Engineer Department.

2nd. As to his power to change the line, grades, plans, schedules, &c., during construction, and :

3rd. His power to issue and enforce " Circular No. 2 and 3, " also " Detailed Specifications for foundations in deep water."

Mr. Flemings report was received and read to the Board yesterday, when it was found that he was in favor of the Chief Engineer, on the 1st and 2nd points ; also as to his power to enforce the "Detailed Specifications." But that he does not believe "Circular No. 2," to be binding upon the Contractor for the reason, as he states, that it is clearly in conflict with the "General Specifications" attached to the contract.

The point of difference specially referred to by Mr. Fleming being, that, as he claims, the "Circular" requires three feet more width of Road-bed than the General Specifications.

Mr. Fleming also decides that a "first class railway" is not provided for in the contract and specifications ; and he recommends, at the close of his report, that a further supplemental contract be negotiated at once, so as to secure a first class Railway.

I take the liberty of enclosing for your information, copies of the questions placed before Mr. Fleming, and his replies thereto, as relating particularly to the above subjects. Also copies of the "Original and Supplemental Contracts," "Opinions of Several Engineers," &c. "Views of the Chief Engineer," &c. "Detailed Specifications," &c., and "Circular No. 2," all of which will enable you to see about how the matter stands with us at present.

There is also another important question, as you will see from the "Review," upon which Mr. Light, the Government Engineer, differs from me, and upon which Mr. Fleming, in another part of his report agrees with him, which is, the proper thickness of piers for bridge masonry.

I need not say to you that the weight of your professional opinion just now, upon all the above matters, will have a very decided influence with the Government, the Board of Directors, and the Public ; and I shall therefore deem it as a very special favor, if you will give me your views at as early a day as practicable for which, I shall be most happy to recompense you in any manner that may be most agreeable to yourself.

I find that I have neglected to state, that Mr. Fleming also agrees with Mr. Light in his views of the necessity of raising the grade so as to obviate the *snow difficulty*.

The Board has ordered Mr. Fleming's report to be printed, and I shall send you a copy at North Adams.

The first thing for the Company to ascertain seems to be, what changes the Government will require in the plan of construction. Second : how much of these changes can be effected under the present contract, and Third : how any additional expenditure is to be provided for, when everything which we now have, is pledged to the Contractor.

Yours very truly,

S. SEYMOUR.

WALTER SHANLY, Esq.,

Revere House, Boston, Mass.

The Chief Engineer to Mr. Shanly.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, February 18, 1875.

MY DEAR SIR,

I should have stated, in my letter of yesterday, that Mr. Fleming says just enough about the crib and pile foundations in deep water to strengthen the impression contained in Mr. Light's Report, as to their being at least "hazardous." This, together with the manner in which he speaks of the masonry, earth-works, &c., has of course a decided tendency to unsettle the minds of the Directors, and Members of the Government, as to everything that has been done upon the Road.

As the subject of these foundations was not referred to in our correspondence of 1873, I have no means of knowing your views about them ; but if you should think favorably of them, it will undoubtedly have the effect to remove many of our difficulties, and enable us to make a united effort to push the work forward to completion, under the present contract, which to me seems our only alternative, if the road is to be built at all.

Yours very truly,

S. SEYMOUR

WALTER SHANLY, Esq.,

Revere House,

Boston.

Mr. Shanly to the Chief Engineer.

NORTH ADAMS, MASS, U. S.

22nd February, 1875.

MY DEAR SIR,

I have to acknowledge receipt of your letters of 17th and 18th inst., referring to me, for my opinion, certain matters in variance between yourself as Chief Engineer, and the Contractor for the construction of the North Shore Railway; and also certain points of difference in professional opinion between yourself and the Inspecting Engineer on the part of the Quebec Government.

The several points submitted are :

1st. As to the right of the Chief Engineer to control the Engineer Department.

2nd. As to his power to change the Lines, Grades, Plans, Schedules, &c., during construction.

3rd. His power to issue and enforce Circulars Nos. 2 and 3.

4th. As to detailed Specifications for Foundations in deep-water.

5th. As to thickness of Bridge-Piers.

6th. As to least elevation of Roadway (on embankments) above the natural surface of the ground.

In the three last questions are involved the points at issue between yourself and the Government Engineer.

UPON THE FIRST POINT :—I am of opinion that the Contract contemplated and provides for the Engineering of the line and, consequently, for the Engineer Department, being committed unreservedly to the Chief Engineer, as right and just it should be. In no other way could the Company be assured of obtaining work of the character, which the Contractors undertook to give. Clause 3 of the General Provisions of the Specification, which is part and parcel of the original contract (April 5th 1872), leaves no room for doubt on this point, and his (the Chief Engineer's)

powers are again referred to and recognized in clause 7 of the same General Provisions, and in various subsequent clauses of the Specification. The work could not truthfully be said to be "under the direct charge and control of the Engineer" unless he had the selection and appointment of his Assistants.

UPON THE SECOND POINT:—*As to changing of lines, Grades, &c.*
—Clause 1, section 1, of the General Specification provides that "the location of the line and the arrangement of grades will be made under the direction and supervision of the Engineer in Chief," which, coupled with clause 3, same section, would seem to clothe the Chief Engineer with full power to make all such changes as he might deem conducive to the permanent advantage of the line. As respects changes of location and grades, however, there is an implied limit, at all events, to the exercise of such power where a contract has been let upon representations made by plans and sections previous to such letting. Material changes subsequently ordered, might so change the features of a line as to make what was at first a fair bargain on both sides, a hard one on the Contractor. While I hold, therefore, that under the North Shore Railway Contract the Chief Engineer has the power to order any changes whatsoever that he may consider advisable, I am nevertheless of opinion that it would look like an exercise of *might* rather than of *right* on his part, to insist on any material departure from any arrangement of location and grades, made and exhibited previous to the making of the Contract, without engaging to compensate the Contractor for all increased expenses that such changes might possibly involve him in.

UPON THE THIRD POINT:—*The Engineer's power to enforce Circulars 2 and 3.*—I have before me the former of these papers; the other (No. 3) did not accompany your letter; my observations must, therefore, be confined to No. 2.

In the very outset, almost, of the original contract (page 3 printed copy) it is "covenanted and agreed" that the "materials, workmanship and fixtures for the construction, equipment,

finishing and completion " of the railway shall be *first class*, conforming to the "annexed specifications," which are "duly acknowledged" by the parties to the contract as forming part thereof. Those specifications repeat (clause 6. section 1.) that all works of construction shall be "first class" of their several kinds ; and the next clause (7) provides, very properly, that as the work progresses working plans and detailed specifications will be "furnished by the Engineer," for the Contractor's guidance of course, and, equally of course, to be binding upon him. Circular No. 2 is just such a detailed specification as the Engineer had, under the General Provision referred to, a right to furnish ; and I can find in it nothing that the Contractor has a just right to dispute. There is nothing in it that clashes with his agreement to give first-class work ; anything less than this Circular requires, would not insure the Company a "first class" railway, even in the ordinary colloquial meaning of the term.

In connection with this point of reference, you direct my attention to two *special* points : The width of earthworks and the character of the Masonry.

In June 1873, you submitted to certain Engineers, of whom I was one, the General Specifications—part of the original Contract—with a view to eliciting their opinions as to whether those specifications, general as their terms are, seemed to provide, with certain stated exceptions, for a "first-class railway." I answered "Yes," that in the usual American (and Canadian) acceptance of the term "first-class," as applied to railways, your specifications certainly contemplate, in respect of all structural requirements, very good work. The question of gradients, or the profile, or section, to enable me to pronounce as to the character of your line in that important feature, were not submitted.

Among the printed documents now before me, I find one containing my letter to you of 9th June, 1873 ; as also the opinions of the other Engineers whose views you then sought. I had not previously been aware that your letter to me, of 4th June (1873),

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was a "Circular," or that in answering it I was undergoing a competitive examination. Had I supposed that the opinion I then wrote you was to be submitted to public criticism, I might have been disposed to amplify it somewhat, and to have gone more into detail, on the merits and demerits of a document on which was to depend the proper or improper construction of an important line of railway. I hereby, however, ratify the opinion I then gave, for whatever it may be worth; and "acknowledge my hand and seal."

EARTH-WORKS.

To come back to the matter under discussion, the width of earth-works, and the character of the Bridge-Masonry, as called for in Circular No. 2, and your right to exact the same from the Contractor; in respect of the former, I avow myself as decided an advocate to day, for narrow embankments in railway construction, as I was a quarter of a century ago for "wide formation," when I fought for 18 and 20 feet at sub-grade; even though everything above that line had to be "robbed" to secure the coveted widths, and that too, very frequently, when money was so scarce that I did not know from month to month from what source the "next estimate" was to be paid. You see, then, that whatever I may be in politics, I am *not* a tory in professional matters.

Your General Specification says (clause 2, sec. 4.) "The road-bed will not be less than 12 feet in width at grade." In my letter of 9th June, 1873, I said that it would have been better to fix a certain *minimum* width of sub-grade. In my own practice I have been in the habit of fixing the *Grade-line* at not less than one foot above "formation" or *sub-grade* level. Reading the opinions of some of my brother Engineers, as called forth by your circular of June 1873, I observe that two of them seem to confound "Grade" and "Sub-grade," or to treat them as "convertible terms," and so condemn your banks as too narrow. To my mind your requirement of "not less than 12 feet wide at *Grade*," conveyed the distinct idea that your *sub-grade* dimension would

be not less than 15 feet, *which is quite enough*; as 12 feet is certainly enough a foot higher up. I do not want my plough to leave snow-lugs on each side of the track, making a trench to invite rapid filling in, the first wind that blows.

Under the terms of the original, or General Specification, you have, in my opinion, a well established right to exact from the Contractor, as in circular No. 2 you do exact, 15 feet width of earthworks at "formation level."

BRIDGE MASONRY.

In my letter of 9th June, above referred to, I drew attention to what I considered a laxity of description as regarded "first class Masonry;" and which I suggested ought to have been defined by mentioning, in stated terms, the amount of cutting that would be required on the joints of the face-stone. Without some such definition the term "First-Class Masonry," a comparative designation *anyhow*, will always be open to misunderstanding as between engineers and builders. What passes, and may properly pass, as first-class work in a railway bridge, could hardly claim second rate classification in a canal lock. In the immediate case before me, however, it seems to me that the detailed specification (Circular No. 2) which you not only had a right, but were in a manner bound, to furnish the contractors, calls for nothing unreasonable in respect of Bridge-Masonry. The contractors were fairly notified in the original contract and specification, that first class work of all kinds, would be expected at their hands, and they, being men of large experience in railway works, undertook to give it; and their assignee, the present contractor, has, in my judgment, no just ground of complaint in being called upon to dress the face-stone of the highest class of Mason-work required of him to quarter-inch joints. The clauses you have incorporated into your Circular from the Intercolonial Railway Specification, exact nothing more than first-class railway masonry; and for that the bargain stipulated, while you have not eliminated from your

detailed or working specification, the breaking-of-courses promised to the contractor in the general one.

UPON THE FOURTH POINT :—*Plan and Specification for Bridge Foundations in deep water.*—If I understand your letter aright, the question here involved is two-fold ; 1st, as to whether you have the power to enforce your plan, &c., the Contractor objecting ; and 2nd, whether the exceptions taken to the plan by the Government Engineer are well grounded.

I am at a loss to understand the " previous question " as to on what plea the *Contractor* objects, seeing that your plan, in point of expense, is largely in his favour as compared with the alternative proposition of coffer-damming, excavating and pumping which, by section 5 of the General Specification, he undertook to risk. The saving of expense in the crib-work-and-piling plan, as against the system of foundations, contemplated by the contract, would be immense ; and as to the Engineers power to " enforce " any plan or specification reasonably within the meaning of the *General Specification*, as this change in foundations undoubtedly is, my opinion is already given under the second point of reference.

In respect of the desirability of the kind of foundation you propose, and which the Government Engineer pronounces " hazardous, " it is beyond controversy that the wood-work would have nothing to fear from the inroads of natural decay. Always under water it would be as durable as the stone itself. I have myself built bridge-piers of which the under-water portions were of crib-work, and now recall one long bridge, in particular, the substructure of which was so constructed ; where, I venture to say, any signs of deterioration that are to be discovered, after twenty-three years of trial, may be looked for rather in the stone work above, than in the wood-work below water.

Next, on the question of *stability*, I am of opinion that, in fitting localities as perfectly secure and stable base, whereon to erect piers of mason-work, may be constructed on the composite plan, forming the subject of discussion, to such a height, some 25 feet,

as your specification contemplates, always assuming that the above water, or Mason-work portion of your pier, will not *much* exceed in height, that of the timber-work portion below.

Where such kind of structure may be judiciously used, however, will always largely depend on local conditions, and not being familiar with any of the places where you design adopting this system, I am not prepared to give more than general views upon it, adding that I would be timorous of using it in streams where the bottom is of shifting character, the current swift, and the ice above, liable to break-up and "run" rather than melt gradually out. Under such a condition of things, the cutting process, which would be relentlessly, and year after year, exercised on the upper courses of the wood-work, might ultimately have a damaging effect on the stability of the structure. There are certain of the *details* of your crib-work in which, were we to sit down together to discuss them, I might be found to differ from you.

FIFTH POINT:—*The sufficiency of your Piers in respect of width on the Bridge-Seat.*—In a matter of this kind I would to a certain extent, also be governed by local condition. Before venturing a decided opinion, I would want to know something of the leading features of the structure to be provided for. Its height above foundation level: the character, as to size, of the stone obtainable for the Masonry, &c., &c.; but from such general knowledge and recollection as I possess of what the ordinary height from river bottom to grade-line is likely to be on the Quebec North Shore Railroad; and also of the stone that, in some localities at all events, is likely to be available, I should say that six feet will be ample width for the top of the piers, and with such stone as I have seen come from Deschambault, for instance, I would not fear to build and guaranty, them on a width of five feet across the coping.

SIXTHLY:—*As to minimum elevation of road-bed over general surface of country, on embankments.*—I am bound to say that the placing of the top of the rail at a height of but two feet above the na-

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tural surface of the adjoining lands appears to me to be quite too low. It will do for *sub-grade* level ; but while so low, for rail-level, as not to admit of the snow being effectually flung aside by the plough, it would also prove, two or three months later, when water-courses are gorged, and every thing a foot or two above field-level *à-fleur-d'eau*, too low to insure a tolerably dry base to the superstructure. Whether you can best raise your low earthworks now while the road is building or, for economic reasons, would do better to defer doing so until after the track is down, I am clearly of opinion that those one-foot-high banks of yours will eventually have to be brought up a foot higher.

Having now addressed myself to each of the points, to which you particularly directed my attention, I would like, since most of the matters in difference seem to have grown out of the interpretation to be put upon the term *first class*, as used in the original Contract and Spécification, to be allowed to add a few words as to my own ideas on the subject.

The designation " first class " was in common use in American Railway phraseology, long anterior to the day, now only in its dawn, of Iron Bridges and Steel Rails. As these and other advances towards greater permanency in the upper works of railway construction become more general, a new classification will doubtless obtain ; and lines hitherto indexed as in the front column, will, if unable to keep pace with the improvements of the time, have to take second rank ; as will also those still to be built which, not having Government coffers, or other equally copious sources of supply to draw upon for construction purposes, cannot be excepted at once to step forth in full panoply of steel and iron.

For the characteristics heretofore entitling American, and Canadian railways to first-class certificates, we have commonly had to look below the ballast. Substantial earthworks, good, durable Masonry in Bridge-piers and Abutments, and the same

in Arch or "Box" culverts, for the minor water courses, with above all else, liberal provision for drainage, were the objects chiefly aimed at by Engineers, with a view to attaining as nearly as practicable to permanency in the road-bed.

Roads so constructed long years ago, are to-day fitted out with steel and iron bridges, with little or no change of the original substructure, and after having undergone three or four renewals of the undoubtedly *second-class* kind of superstructure in vogue when they were built.

Your contract and Specifications contemplate just such work as gave to such roads the high classification accorded to them by general consent, and also provide, in all respects, for just as high a character of road *as the country can afford to have*.

Your *general* Specification is less general in its terms than that under which the Grand Trunk Railway Contracts were let; and it was either drafted in London; or else in Canada by English Engineers "just out."

If Canada is to keep on extending her railway system; or the United States either, for that matter; the *principles* that guided the construction of "first class" roads in the past, will have to be adhered to, though the roads yet to be built may have to put up with a modified *classification*.

On the plan you are endeavoring to carry out in Quebec, there is every prospect of our having ere long the long-hoped for North Shore Railway; while, had the new reading of the term "first-class" been adopted in the outset, the work, it is safe to say, would not yet have been begun; and, if it is to be enforced now, will probably never be completed; not, at all events, in your time or mine.

Yours very truly,

W. SHANLY.

General S. SEYMOUR,
Chief Engineer,
North Shore Railway,
Quebec.

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APPENDIX No. 6.

CORRESPONDENCE WITH MR. FLEMING.

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APPENDIX No. 6.

CORRESPONDENCE WITH MR. FLEMING.

The Chief Engineer to Mr. Fleming.

OFFICE OF THE ENGINEER IN CHIEF,

Quebec, February 22, 1875.

MY DEAR SIR,

Through the kindness of the Secretary, I have just had an opportunity of reading, with some care, your report to the President of the Company upon the affairs of this Road, under date of the 10th inst.; and am exceedingly gratified to find that in many of the points submitted to you, consisting of the power of the Engineer, under authority of the Board of Directors, to control the Engineer Department; to change the line, plans, schedules, &c., &c., during construction; and generally to exercise supreme control over the work for the proper execution of which he is held responsible, are so fully in harmony with my own views.

There are however, one or two other very important matters upon which your opinion differs so radically from my own, that I trust you will pardon me for calling your attention to them again, in the hope that a further exchange of views may lead to a somewhat nearer approach to that harmony of sentiment and action which I feel to be so very essential in the present state of our affairs.

I refer particularly to your views as to the general

character of the Road, if constructed under the present contract and specifications; and also to your opinion that "Circular No. 2," is not authorized by the contract.

It is proper to mention that, before accepting the position of "Advisory Engineer," you called the attention of the Board of Directors to the fact that you had already committed yourself upon the subject of the *class* of road provided for under the present contract, in a correspondence with the Chief Engineer upon that subject in 1873; and that you should therefore decline to act in the matter, at the present time, unless it should be with the full concurrence of the Chief Engineer. I should mention further that, upon being called before the Board, I gave my full consent to your acting, with the understanding, which was assented to by the Board: 1st, that your views should not be considered as binding, either upon the Company or myself, so far as they related to the matters upon which you had previously expressed an opinion; and 2nd that in taking final action in the matter, the Board would give due consideration to the fact of your having previously pre-judged the case; as well as of the fact, that your professional practice had hitherto been very different from my own in many particulars that could but have a very decided bearing upon several of the most important questions presented to you.

On referring to my letter of the President of the Company, dated June 5th 1873, (page 8 of pamphlet containing "Opinions of Several Engineers, &c.,") it will be observed that, after informing him that I had taken the liberty of soliciting these opinions, I assure the Board "that they will have a controlling influence in my own mind in the consideration of any matter *that is left open to the decision of the Engineer during the progress of the work.*"

Upon receiving, and carefully examining these opinions, I found in three of them, a very remarkable unanimity of views upon at least one point in the contract and specifications, that is, the one which relates to the *power of the Engineer.*

M. Shanly says: "But then the power of deciding all open questions is placed so entirely in the hands of the Engineer (as it should be,) &c."

Mr Keefer says: "In this contract everything depends on the Engineer, who is the specification," &c.,

Mr. Fleming says : " Everything is vague and left to the discretion of the Engineer," also, " Everything is left to the Engineer," &c. " It would be quite possible under these Specifications to build a Railway of a substantial character," &c.

Upon examining your own objections to the character of the Road provided for in the contract and Specifications, I found that they related principally to the *width of the earthworks*, and the *character of the masonry* ; and I therefore proceeded to prepare such " Explanatory or detailed Specifications," as I believed, under your own construction of the contract, I had the power to do ; and such as I thought would meet your objections, and at the same time redeem my promise to the Board of Directors.

I will very frankly confess, that it was my firm belief that you would now sustain me in the exercise of that power ; and also that you would decide that " Circular No. 2," covered most, if not all of the objectionable points which you had previously raised, respecting the character of the work, and the vagueness of the General Specifications, that influenced me, to a great extent, in consenting to your being again called upon to express an opinion upon a matter respecting which you had previously committed yourself.

In fact, I felt so clear upon this point myself, that I did not think it necessary to trouble you with any arguments upon the subject, further than the submission of the naked question, accompanied by the Circular itself, which as I believed, contained in its own preamble the most convincing argument that could be made upon the subject.

Under the foregoing circumstances ; and also in view of the very great importance which I attach to this particular branch of the case, I trust that you will pardon me for asking you to re-consider your answers to questions 12 and 16, in so far as to allow the views which I may now present, to have the same weight in your mind, as they would have had if presented previously to your having given your present answers ; which answers I find coincide substantially with the views previously expressed in your letters to me upon the same subject.

The General Specifications say : " The road-bed for single track *will not be less than twelve feet in width at*

grade ; but will be increased on embankments, according to height, or *character of material*, at the *discretion* of the Engineer."

The 7th clause in the specification for graduation, and the 9th clause in the specification for superstructure, provide that "when the native material is unsuitable for sustaining the permanent track" or "for ballasting the track," (which are evidently synonymous terms) "other suitable material shall be substituted therefor," &c.,

You seem to have inferred, both in your letter to me of June 11, 1873, and also in your recent report to the President of this Company that the *minimum* of 12 feet is at the *base* instead of the *top* of the ballast ; and you therefore compare this minimum of 12 feet, with your own approved minimum of 17 feet at *sub-grade* or *formation level*, and very naturally conclude that our width is 5 feet too narrow ; and that it is not sufficiently wide to hold the ballast.

I must confess my utter inability to comprehend how, under the plain reading of the Specifications, you arrive at the conclusion, either that this width of 12 feet is at sub-grade ; or that the Engineer has not the power to increase the width of road-bed at grade, to any extent that in his opinion the character of the material may render necessary, in order to secure for the base of the superstructure a good bearing width of *not less than 12 feet* upon material that is every way suitable for ballast ; and also why, if the Engineer has this power, and chooses to exercise it, your comparison should not be based upon a width of 15 instead of 12 feet at sub-grade or formation level.

It has occurred to me, however, that this misunderstanding may be the result of the different meaning which, in our respective practices, we may have attached to the terms : "Road-bed." "Formation Level," "Sub-Grade," &c.

In my own practice I have always regarded the top of the "Road-bed" as representing substantially the same elevation, when fully completed and ballasted, as the bottom of the cross-tie or superstructure of the track ; and the terms "Formation Level" or "Sub-Grade" (which I assume to be synonymous) as representing the *base* of the ballast, whenever it is found necessary to substitute a better material for the bed of the superstructure, than the native material of which the Road-bed may be composed.

To assume that the width of "Road-bed," was to be only 12 feet at "Formation Level" or "Sub-Grade," when the nature of the material was such as to require one foot in depth of ballast; thus reducing the top width of ballast to *nine* feet, has certainly never entered into my own mind; and I am quite sure that neither the former Contractors, nor the present Contractor have ever placed such a construction upon the Specifications.

To show you that my present views upon this subject, are the same that I have always entertained, I have but to refer to my letter to you of June 18th 1873, in which reference is also made to the same views as contained in my "Gauge Pamphlet," which was written in 1871.

In the copy of the General Specifications for the Main-Line, which in February, 1872, I submitted for the approval of the Board of Directors, the following language was used:

"2. The Road-bed for single track will *generally* be twelve feet in width at grade," &c.; but at the suggestion and special request of Honorable P. Garneau, then Mayor of Quebec, and now Commissioner of Public Works for this Province, the word "generally," was stricken out, and the words "not less than" substituted therefor, so that, as he expressed it "there could be no possible mistake upon this point."

If I have succeeded in satisfying you that the question of the width of Road-bed, *immediately under the tie*, is fully understood by all parties hereto be "not less than 12 feet" *under any circumstances*; and consequently that the width of the Road-bed at sub-grade, must be at least 15 feet, and as much wider as the Engineer may deem necessary, "according to height of bank or character of material," may I ask you, in comparing this width of 15 feet at sub-grade, with your own approved width of 17 feet, to state some of the more prominent reasons, why in your opinion, a greater width than 12 feet, is required at the base of the tie; and also why a greater width than 15 feet is desirable for the ballast to rest upon, which generally slopes from 1, to $1\frac{1}{4}$ to 1.

Referring also to that portion of "Circular No. 2," which relates to "Masonry," will you kindly inform me of the particular clauses which in your opinion are in conflict with the General Specifications. It has occurred to

me that if the entire 3rd clause was stricken out ; or perhaps if the words " and details " were stricken out from the third line of the 3rd clause, you might consider the balance as being within the authority and requirements of the contract.

I beg leave to state, however, for your information, that no question has thus far arisen between the Contractor and the Engineer as to the character of the Masonry already built ; and I have no reason to suppose that any question of the kind will be raised in future.

Will you also kindly inform me of the increased width or weight that you would give to my plans for masonry ; and also of the modifications which you would suggest in my plans and specifications for foundations in deep water. I will take the liberty of enclosing another copy of " Circular No. 2," with the request, if not giving you too much trouble, that you will erase, alter or interline it, in such a manner that when taken, either as a whole or in any of its parts, it may be regarded as foreshadowing the decision of the Engineer ; or rather deciding in advance, such questions as in your opinion are clearly left open for his decision, in the existing Contract and General Specifications,

I beg to remain,

My dear Sir,

Yours very truly,

S. SEYMOUR,
Chief Eng. N. S. R

SANDFORD FLEMING,
Chief Eng. C. P. R. R
Ottawa.

The Chief Engineer to Mr. Fleming.

OFFICE OF THE ENGINEER IN CHIEF,
Quebec, February 23, 1875.

My Dear Sir,

I beg to enclose extra copies of "Circular No. 2," which I find were omitted from my enclosure of yesterday.

If you should conclude to open or re-consider any portion of your report of the 10th inst., I will thank you to re-consider especially the ground you take respecting the *precedence* which should be given to the "General Specifications" over the *expressed conditions* contained in the *body of the contract* to which it is annexed. And also, please give due consideration to the 3rd and 6th clauses of the General Specifications, under the head of "General Provisions." My own views upon this subject are expressed on 2nd and 3rd pages of the Pamphlet containing "Opinions of several Engineers," &c., also on the 15th and 16th pages of the "correspondence," contained in the same Pamphlet.

I desire to assure you, my Dear Sir, that my only object in asking you to re-consider any portion of your former report, is if possible to find some common ground upon which we may meet, and act together in the promotion of the true interests of the Railway Company; which interests, I am firmly persuaded, will be placed in great jeopardy by the re-opening of the present contract, as you at present advise.

Your very truly,

S. SEYMOUR,

SANDFORD FLEMING, Esq.,
Ottawa.

Mr. Fleming to the Chief Engineer.

Canadian Pacific and Intercolonial Railways,

OFFICE OF THE ENGINEER IN CHIEF,

OTTAWA, Feb. 24th 1875.

MY DEAR SIR,

I am this day in receipt of your favor of the 22nd instant.

I regret exceedingly that I cannot comply with your wishes with regard to reconsidering some of my answers to the questions which were recently submitted to me by the Board of Directors of the North Shore Railway. I have had no communication with the Board on the subject since I sent my report, on the 10th inst. The subject has not since engaged my attention, and I have nothing to add or take away from what I then submitted; and I could not conveniently take it up at this time, so as to give it that consideration which it deserves, without seriously neglecting other duties which are now pressing on me.

Under all the circumstances, I trust you will not consider me at all discourteous in thus simply acknowledging the receipt of your letter at this time.

Believe me,

My dear Sir,

Yours very truly,

SANDFORD FLEMING

Genl. S. SEYMOUR,

Chief Engineer,

N. S. Ry.

Feb. 25th.

P. S.—I wrote the above before seeing your telegram, announcing that a second letter had been forwarded me, and asking me to wait until its receipt. Yours of the 23rd is now received and I have telegraphed the President of your company on the subject. For the present I am sure you will pardon me declining to take up the subject again.

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APPENDIX No 7.

CORRESPONDENCE RESPECTING
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APPENDIX No. 7.

CORRESPONDENCE RESPECTING LEGAL OPINION.

The Chief Engineer to the Secretary.

OFFICE OF THE ENGINEER IN CHIEF,
Quebec, February 20, 1875.

DEAR SIR,

In a communication addressed to the President and Directors of the Company, on the 30th January last, I had the honor to state, that: "in view of the great importance to the Railway Company, of the questions herein discussed; as well as others which are now pending with the Government and the Contractor, I would respectfully, but earnestly recommend that the Company take measures necessary to ascertain its legal position and rights under the contract, at the earliest possible day.

Having learned from you that no such measures have as yet been taken by the Company; and believing it of the greatest importance that the legal position of the Company should be fully understood by the Board of Directors, I have taken the liberty of preparing and enclosing to you herewith, some of the points which I consider to be of the most pressing importance, for submission to the Legal Advisers of the Company.

I beg leave respectfully to ask that I may be furnished with legal opinions upon the points referred to, in time to enable me to prepare some remarks upon the present situation of the Company's affairs, which I propose to submit for the consideration of the Board of Directors at its next meeting, which I understand is to be held on Tuesday of next week.

I have the honor to remain.

Mr. Secretary

Your Obt. Servt.,

S. SEYMOUR

Eng. in Chief.

A. H. VETRET, Esq.,
Secretary, N. S. R. Co.,
Quebec.

NOTE.—The points enclosed in the above letter will be found in the following opinion.

LEGAL OPINION

OF MESSRS. ALLEYN AND CHAUVEAU.

Quebec, 1st March, 1875.

A. H. VERRET,
Secty. N. S. R. Co.,

SIR,

We have the honor to acknowledge the receipt of your letter of the 25th ult. containing the questions hereinafter contained, and requesting our opinion concerning the same, which we send :

1st. Referring to the original contract and general specifications for the Main Line. The contract clearly calls for the construction of a "first class Railway." Do the general specifications contain any provisions which have the effect to release the Contractor from the clearly expressed requirements of the contract to which they are annexed ?

Answer. The general specifications referred to, form part of the contract. They do not release the Contractor from his obligation to construct a "first class Railway" such as contemplated by the parties to the contract. The express undertaking is to build "a first class Railway;" and the parties have defined by the specifications in question what, under said contract, they consider a "first class Railway," leaving therein great control to the Engineer in Chief. In other words, the Contractor is bound to construct a Railway in conformity with the contract, and not beyond the requirements of the specifications.

2nd. Referring to the original contract and specifications : are the powers therein delegated to the Engineer in Chief of the Railway Company, when taken in connection with the other provisions therein contained, sufficient if properly exercised, and complied with by the Contractor, to secure a "first class Railway," as that term was understood by the respective parties thereto, at the date of the contract ?

Answer. The powers delegated to the Engineer in Chief are, in

our opinion, ample, if properly exercised, and complied with by the Contractor, to secure a "first class Railway," as that term appears to have been understood, and is used by the respective parties in the contract.

3rd. Referring to the 3rd & 6th clauses of the general specifications for the Main Line under the head of "General Provisions;" also 2nd & 7th clauses under the head of "Graduation;" and 9th clause under the head of "Superstructure." Has the Chief Engineer the power to require that the road-bed shall be of any width, not less than twelve feet, at grade or the bottom of the cross tie. And also that the character of the material of which the top of the road-bed is composed, shall be suitable for sustaining and ballasting the permanent track?

Answer. The Engineer in Chief has, under the contract and the general specifications, the power referred to in this question.

4th. Referring to the accompanying "Circular No. 2;" are the provisions and directions therein contained, such as are authorized by the contract, and the specifications thereto attached?

Answer. The language and expressions used in "Circular No. 2" are, in several respects, different from the terms used in the contract and specifications; and we are not prepared, without further explanation, to say if all the provisions and directions contained in such circular, are authorized by the said contract, and specifications thereto attached. We are however inclined to think, that the provisions contained in said circular under the heads of "Right of Way," "Fencing," "Earth Works," and "Drainage," are authorized by the contract and general specifications. An Engineer could, we believe, more readily answer this question than a lawyer.

5th. In case of a violation of the contract by the contractor, in not complying with the directions of the Engineer as to the manner of executing the work; in not progressing with the work to the satisfaction of the Chief Engineer, so as to complete the road within the time specified in the contract; in not furnishing the Railway Company with the money when required to pay for the right of way; or in not paying the Engineering expenses of the Company; what is the proper remedy of the Railway Company under the existing contract?

Answer. Under the supplemental contract of the 2nd February 1874, the work of construction is to be commenced immediately after the signing of the contract, and to be proceeded with to the satisfaction of the Chief Engineer of the Company; and the Directors have the right to have the contract declared cancelled if the work is not commenced within six months from the signing of the contract, and proceeded with continuously thereafter. Under the above terms, we are of opinion that, in the event of the Con-

tractor violating his contract, as mentioned in said question, the Directors would have the right to take steps to have the contract cancelled, and to sue the Contractor for any liabilities incurred by him towards the Company under the said contract; and in the event of the Contractor not furnishing the Railway Company with the money required to pay for the right of way; or not paying the Engineering expenses of the Company, the Directors would moreover have the right to retain out of any monies, in their hands, due to the Contractor, a sum or sums sufficient to meet the above requirements.

Your Obt. Servants,

(Signed,) ALLEYN & CHAUVEAU.

NORTH SHORE RAILWAY.

CIRCULAR No. 2.

(Referred to in the above opinion.)

FOR THE INFORMATION AND GUIDANCE OF THE ENGINEER DEPARTMENT AND CONTRACTORS;

With reference to certain matters which are left open for the decision of the Engineer, in the General Specifications for the Main Line.

The contract for the construction and equipment of the North Shore Railway, and the general specifications attached thereto, provide for a *first-class railway* in all respects, so far as the main line between Quebec and Montreal is concerned.

The fact that this was made a condition precedent, which must be complied with before either the Railway Company, or the Contractor, would be entitled to receive the large amount of aid granted to the road by the Provincial Government, and the City of Quebec, rendered it unnecessary to embody in the original specifications, all the details which are usually contained in the specifications for a first-class railway; and many matters of importance were therefore left to the decision of the Engineer, during the progress of the work.

In view of the great importance of insuring a perfect understanding, and harmony of action, at the out-set; as well as uniformity in the character of work upon all portions of the line; and also for the purpose of facilitating the proper execution of the work; and of carrying out the true spirit and meaning of the

contract and original specifications, the following *explanatory* or *detailed* specifications have been prepared in relation to the different classes of work hereinafter referred to, so far as any contingency connected therewith can now be foreseen and provided for.

I. RIGHT OF WAY.

1. The Right of Way must be secured of sufficient width for the construction of the Railway; and also to allow of the boundary fences being built entirely upon the Company's land, without interfering, either with adjoining lands, or with top slopes of excavations, side drains, and borrowing pits required to be made during the construction of the Railway.

2. At points where Stations may be located, the extra width required will be designated by special instructions from the office of the Engineer in Chief.

II. FENCING.

1. The character of the fencing and gates along the boundary lines of the Railway, as regards the durability of the materials of which they are composed, and the style and workmanship of their construction, must be fully up to the standard of the fencing and gates in general use upon the first-class farms contiguous to the Railway, in the Parishes and Counties through which the Railway passes.

III. EARTH WORKS.

1. The grade line as indicated upon the profiles, is intended to represent the elevation of the bottom of the cross-tie in the superstructure.

2. The minimum width of *twelve feet*, as specified for single track, is intended to apply only to cases, both in excavations and embankments, where the native material is of sand or gravel, suitable for the reception of the superstructure without requiring ballast; but when such is not the case, the road-bed will be left with a top width of fifteen feet at sub-grade, so as to allow of one foot in depth of ballast, and a finishing width of twelve feet at grade.

3. The elevation of the sub-grade, will generally be one foot below the grade line, as indicated upon the profiles; but it may vary from this at the discretion of the Engineer, after allowing for proper gradients for the superstructure.

4. The finishing width of twelve feet, as above specified, is intended to apply to the road-bed after becoming fully settled; and after the slopes have become firmly fixed in position, so as to be free from the dangers of scouring, slides, &c.; and the Engineer

in charge must make due allowance, in extra widths, for height of banks, character of material, and other contingencies of this nature, during the progress of the work.

5. Surface, or catch-water drains, must be excavated at a proper distance above the top slopes of excavations, in wet ground, whenever they will have a tendency to turn the water from the slopes and road-way, and lead it into an adjacent culvert or sluice.

6. The present line of location is intended to be the center line of the single track now to be constructed; and the space reserved for an additional track, will be twelve feet in width; and will, as a general rule, be located upon the Southerly side of the present road-bed; but the Engineer in charge may depart from this rule in exceptional cases, having due regard to the distribution and procuring of material, and also to the proper future alinement of the track.

7. Whenever there is a scarcity of material for embankments, the space reserved for the double track may be encroached upon for borrowing purposes, to a sufficient extent to avoid the necessity of hauling long distances: but before doing this, the adjoining excavations, if within hauling distance, will be excavated to the full width required for double track, or even a greater width if necessary, and the material hauled into bank.

8. In excavating side drains and borrowing pits, care must be taken to leave a sufficient berme, with proper slopes, for sustaining the embankments, and also the division fences, without endangering their stability or usefulness. The width of this berme will generally be two feet, but may be governed by the nature of the material, the height of banks, and the depth of side excavations.

9. The side drains at the foot of the upper side slopes in excavations, whatever may be the depth of cut, or nature of the material, should never be less than one foot in depth, one foot in width at bottom, and four feet in width at top, when the road-way is ready for the superstructure; and they should always have sufficient longitudinal inclination to carry off the water with facility. Upon the lower side slopes, where the surface drainage is away from the Railway, and the slopes are of moderate height, these drains may be reduced in size. Where the cuts are excavated to sub-grade, these side drains should never be less than one foot in width at bottom, and one half foot in depth below sub-grade. In cases of very wet material, or where a considerable volume of water is necessarily carried through these drains to a cross opening, they will be increased in dimensions to suit the circumstances.

10. In side hill work, where materials for the adjacent banks are scarce, it is desirable to borrow from the lower side of thorough cuttings to as great an extent as practicable, even to the remo-

ving of the entire body of earth down to the level of the grade, from that side of the road-bed, in order to avoid obstructions from snow, and to facilitate the drainage of the road-bed.

11. The Engineer in direct charge of the work will bear constantly in mind the paramount necessity in this climate, of guarding against the danger of obstructions from snow, in the future running of the road; and he will be expected to adopt every practicable expedient to obviate this danger, both in the formation of earth works, and in the borrowing and disposition of material; having in view also the future construction of snow fences along the line, at all exposed points.

IV. DRAINAGE-

1. The question of cross or lateral drainage will be made the subject of special observation and study by the Engineer in direct charge of the work; and great care must be taken to adopt openings of sufficient sectional area to pass the waters of the highest floods ever known, or likely to occur in the locality. In cases of doubt, the decision should always be upon the side of safety.

2. Open or beam culverts and sluices will be avoided in all cases where covered box culverts will safely answer the purpose, and where the depth of bank upon the covering will be sufficient to protect the masonry from injury by the passage of trains. Two feet in depth of earth, below the bottom of the cross tie, should be regarded as a minimum. French drains, and tubes, composed of iron or other suitable materials, may be used in cases where it can be done with safety.

3. The side walls of open water or road-ways, cattle guards, &c., of twelve feet spans and under, will be left two feet below grade, in order to allow for a wall plate and longitudinal sleeper for the support of the cross-ties. Whenever the spans exceed twelve feet, these structures, as also the masonry required for piers and abutments of truss bridges, will be made to conform to the specific plan of such structure.

V. CATTLE GUARDS.

1. Cattle guards will generally be constructed of stone masonry, of the character described in the 6th paragraph, under the head of MASONRY, in the General Specifications. This will always be the case when they are used for purposes of lateral drainage; but when this is not the case, and when suitable stone is not easily attainable, they may, at the discretion of the Engineer in charge, be constructed of good sound Cedar, or other equally durable timber, after the plans adopted upon other first class Railways in Canada.

VI. MASONRY.

1. The term *First-class rubble masonry*, as used in paragraph 2, under the head of MASONRY, in the General Specifications, is intended, so far as regards strength, durability, general appearance, and proper adaptation, to secure work which shall be fully up to the standard for similar structures upon the Intercolonial, Grand Trunk, Great Western or any other first-class Railway in Canada.

2. The exception with reference to broken or irregular courses, in extreme cases where the quarry will not afford stone of uniform thickness for every course, must not be construed in such a manner as to result in work which shall be inferior in strength and durability, to ordinary first-class ranged work.

3. The following extract from the *Specifications for the Intercolonial Railway* is given as a guide to the Engineer in charge, Contractors and Inspectors, with reference to the general character and details of this class of work in the more important structures upon this road :

" 42. *First-class masonry* shall be in regular courses, of large well shaped stone, laid in mortar on their natural beds, the beds and vertical joints will be hammer dressed, so as to form quarter-inch joints. The vertical joints will be dressed back square 9 inches, the beds will be dressed perfectly parallel throughout. The work will be left with the "quarry face," except the outside arrises, strings and coping, which will be chisel dressed.

43. The courses of first class masonry will not be less than twelve inches, and they will be arranged in preparing the plans to suit the nature of the quarries, courses may range up to 24 inches, and the thinnest courses invariably be placed towards the top of the work.

44. Headers will be built in every course not further apart than 6 feet, they will have a length in line of wall of not less than 24 inches, and they must run back at least $2\frac{1}{2}$ times their height, unless when they will not allow this proportion, in which case they will pass through from front to back. Stretchers will have a minimum length in line of wall of 30 inches, and their breadth of bed will be at least $1\frac{1}{2}$ times their height. The vertical joints in each course must be arranged so as to overlap those in the course below 10 inches at least.

45. The quoins of abutments, piers, &c., shall be of the best and largest stones, and have chisel drafts properly tooled on the upright arris, from two to six inches wide, according to the size and character of the structure.

46. Coping stones, string courses and cut-waters shall be neatly dressed in accordance with plans and directions to be furnished during the progress of the work.

47. The bed stones for girders shall be the best description of

sound stone, free from drys or flaws of any kind, they must be not less than 12 inches in depth for the smaller bridges, and eight feet superficial area on the bed. The larger bridges will require bed stones of proportionally greater weight; these stones shall be solidly and carefully placed in position, so that the bridge will set fair on the middle of the stone.

48. The backing will consist of flat bedded stones, having an area of bed equal to four superficial feet or more. Except in high piers or abutments two thicknesses of backing stone but no more will be allowed in each course, and their joints must not exceed that of the face work; in special cases where deemed necessary by the Engineer to insure stability, the bedding shall be in one thickness; the beds must, if necessary, be scabbled off, so as to give a solid bearing. No pinning will be admitted. Between the backing and face stones there must be a good square joint, not exceeding one inch in width, and the face stones must be scabbled off to allow this. In walls over three feet in thickness, headers will be built in front and back alternately, and great care must be taken in the arrangements of the joints, so as to give perfect bond.

49. Every stone must be set in a full bed of mortar and beaten solid, the vertical joints must be flushed up solid, and every course must be perfectly level and thoroughly grouted."

Should contingencies occur during the progress of the work, which have not been referred to, or provided for in the above, they will be immediately reported to the office of the Engineer-in-Chief for further information and instructions.

SILAS SEYMOUR,

Engineer-in-Chief.

Quebec, June 12, 1874.